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Naval Postgraduate School
Monterey, California 93943-5138

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Compilation of

Thesis Abstracts

March 2009

Office of the Vice President and Dean of Research
Naval Postgraduate School

PREFACE

This publication contains abstracts of unrestricted or unclassified theses submitted for the degrees doctor of philosophy, master of business administration, master of science, and master of arts for the March 2009 graduation. Classified and restricted distribution abstracts are listed on the NPS SIPRnet.

This compilation of abstracts of theses is published in order that those interested in the fields represented may have an opportunity to become acquainted with the nature and substance of the student research that has been undertaken. Copies of theses are available for those wishing more detailed information. The procedure for obtaining copies is outlined on the last page of this volume.

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INTRODUCTION

Mission

The Naval Postgraduate School (NPS) was established to serve the advanced educational needs of the Navy. The broad responsibility of the school is reflected in its stated mission:

> Increase the combat effectiveness of U.S. and allied armed forces and enhance the security of the United States of America through advanced education and research programs focused on the technical, analytical, and managerial tools needed to confront defense-related challenges of the future.

To fulfill its mission, the Naval Postgraduate School strives to sustain excellence in the quality of its instructional programs, to be responsive to technological change and innovation in the Navy, and to prepare officers to introduce and utilize future technologies.

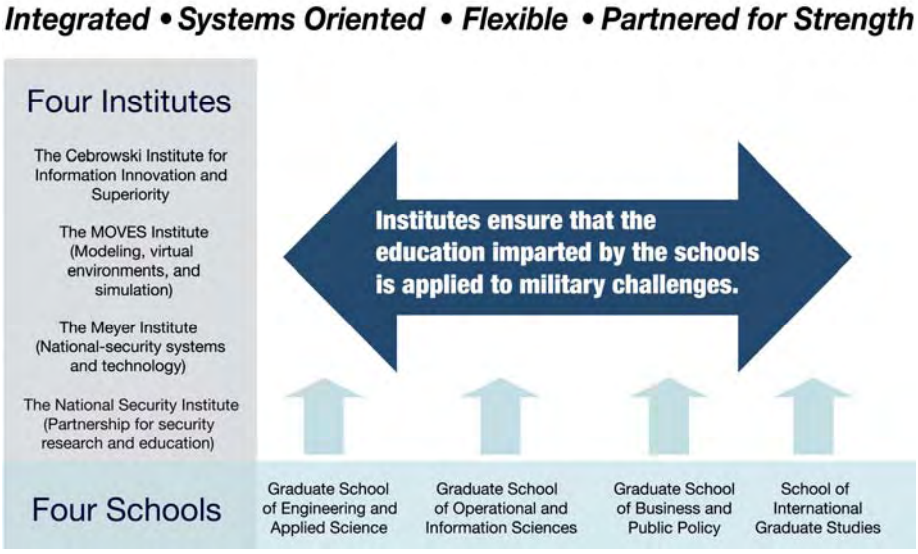
The research program at NPS exists to support the primary mission of graduate education. Research at NPS:

- maintains upper-division course content and programs at cutting edge;
- challenges students with creative problem solving experiences on DoD-relevant issues;
- advances DoN/DoD technology;
- solves warfare problems; and
- attracts and retains quality faculty.

Academic Programs

To meet its educational requirements, the Navy has developed a unique academic institution at the Naval Postgraduate School through the use of specially tailored academic programs, and a distinctive organization tying academic disciplines to naval and joint warfighting applications.

The Naval Postgraduate School has aligned its education and supporting research programs to achieve three major goals: 1) academic programs that are nationally recognized and support the current and future operations of the Navy and Marine Corps, our sister services, and our allies; 2) institutes that focus on the integration of teaching and research in direct support of the four pillars of Joint Visions 2010 and 2020 and their enabling technologies; and, 3) executive and continuing education programs that support continuous intellectual innovation and growth throughout an officer's career.



INTRODUCTION

Programs of graduate studies at NPS are grouped as follows:

Graduate School of Operational and Information Sciences

- Computer Science
- Computer Technology
- Electronic Warfare Systems
- Human Systems Integration
- Information Sciences
- Information Systems and Operations
- Information Systems and Technology
- Information Warfare
- Joint C4I Systems
- Joint Information Operations
- Modeling, Virtual Environments, and Simulation
- Operations Analysis
- Operational Logistics, Joint
- Software Engineering
- Special Operations and Irregular Warfare
- Systems Analysis

Graduate School of Engineering and Applied Sciences

- Applied Mathematics
- Combat Systems Science and Technology
- Electronic Systems Engineering
- Meteorology
- Meteorology and Oceanography
- Naval/Mechanical Engineering
- Oceanography
- Operational Oceanography
- Reactors–Mechanical Engineering/Electrical Engineering
- Space Systems Engineering
- Space Systems Operations
- Systems Engineering
- Systems Engineering Management
- Undersea Warfare
- Underwater Acoustic Systems

Graduate School of Business and Public Policy

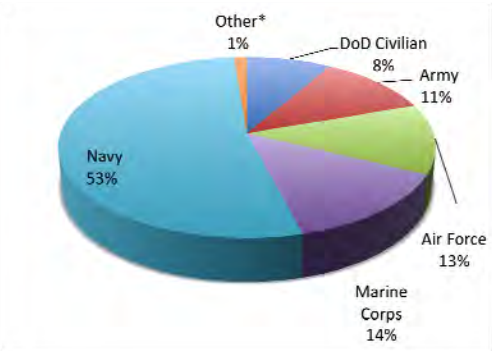
- Acquisition and Contract Management
- Contract Management
- Defense Business Management
- Defense Systems Analysis
- Defense Systems Management, International
- Executive Management
- Executive Master of Business Administration
- Financial Management
- Information Systems Management
- Material Logistics Support
- Manpower Systems Analysis
- Program Management
- Resource Planning and Management for International Defense
- Supply Chain Management
- Systems Acquisition Management
- Transportation Management

School of International Graduate Studies

- Civil–Military Relations
- Combating Terrorism: Policy, Strategy
- Defense Decision Making and Planning
- Homeland Defense and Security
- Homeland Security and Defense
- Security Studies
- Stabilization and Reconstruction
- National Security and Intelligence:
  - Middle East, South Asia, Sub-Saharan Africa
  - Far East, Southeast Asia, Pacific
  - Europe and Eurasia
  - Western Hemisphere

Students

The student body consists of U.S. officers from all branches of the uniformed services, civilian employees of the federal government, and military officers and government civilian employees of other countries. The resident degree/subspecialty student population for March 2009 is shown in Figure 1 on the following page.



*Army Reserve, Army Reserve National Guard, Coast Guard, National Guard, National Oceanographic and Aeronautics Administration

Figure 1: Resident Degrees/Subspecialty Student Population for March 2009 (1452 Concurrently Enrolled)

Academic Degrees

Curricula meet defense requirements within the traditional degree framework. All curricula lead to a master's; additional study may yield an engineer's or doctoral degree. Below is a listing of the degrees offered at NPS:

Master of Arts Degrees
National Security Affairs
Security Studies

Master of Business Administration

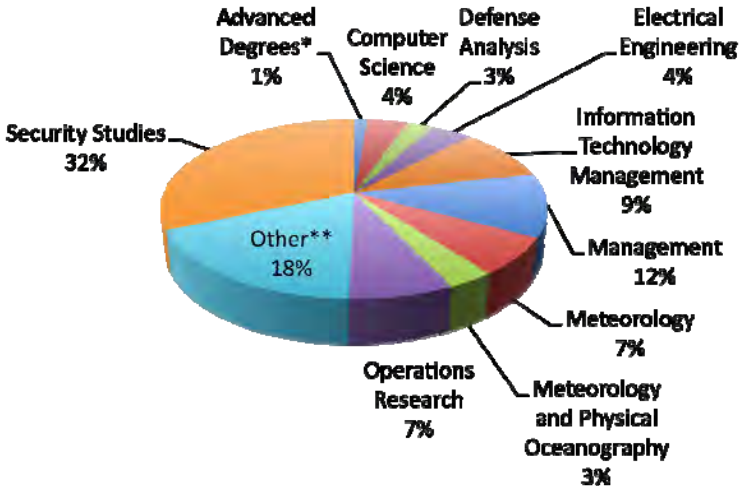
Master of Science Degrees
Applied Mathematics
Applied Physics
Applied Science
Astronautical Engineering
Combat Systems Technology
Computer Science
Computing Technology
Contract Management
Defense Analysis
Electrical Engineering
Electronic Warfare Systems Engineering
Engineering Acoustics
Engineering Science
Human Systems Integration
Information Operations
Information Systems and Operations
Information Technology Management
Information Warfare Systems Engineering
Management
Materials Science and Engineering
Mechanical Engineering
Meteorology
Meteorology and Physical Oceanography
Modeling, Virtual Environments, and Simulation
Operations Research
Physical Oceanography
Physics
Product Development
Program Management
Software Engineering
Space Systems Operations
Systems Analysis
Systems Engineering
Systems Engineering Analysis
Systems Engineering Management
Systems Technology

Engineer Degrees
Astronautical Engineer
Electrical Engineer
Mechanical Engineer

Doctor of Philosophy
Applied Mathematics
Applied Physics
Astronautical Engineering
Computer Science
Electrical Engineering
Engineering Acoustics
Information Sciences
Mechanical Engineering
Meteorology
Modeling, Virtual Environments, and Simulation
Operations Research
Physical Oceanography
Physics
Security Studies
Software Engineering

In March 2009, 165 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.

Figure 2. Distribution by Degree Type
(165 Degrees Conferred)



*Advanced degrees: doctorate in astronautical engineering, two electrical engineers
**Other master's degrees: applied mathematics (3), applied physics (1), business administration (2), contract management (1), electronic warfare systems engineering (1), engineering acoustics (2), information systems and operations (3), information operations (1), mechanical engineering (3), modeling, virtual environments, and simulation (1), physical oceanography (3), software engineering (1), systems engineering management (1), systems engineering (4)

Figure 3. Degrees Conferred in March 2009
(165 Degrees Conferred)

Theses

The thesis is the capstone of the student's academic endeavor at NPS. Thesis topics address issues ranging from the current needs of the fleet and joint forces to the science and technology that is required to sustain long-term superiority of the Navy/DoD.

Aided by their faculty advisors, NPS students represent a vital resource within the DoD for addressing warfighting problems, one especially important at present, when technology in general, and information operations in particular, is changing rapidly. Our officers think innovatively and possess the knowledge and skill to apply nascent technologies in the commercial and military sectors. Their first-hand grasp of operations, when combined with a challenging thesis project that requires them to apply their focused graduate education, is one of the most effective elements in solving fleet/joint-force problems. NPS graduate education encourages a lifelong capacity for applying basic principles to the creative solution of complex problems.

NPS is unique in its ability to conduct classified research. Restricted theses are available on the NPS SIPRNET.

Figure 4. Classification of Theses
(165 Degrees Conferred)

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ADVANCED DEGREES

Doctor of Philosophy
Electrical Engineer

DOCTOR
OF
PHILOSOPHY

FINE SURFACE CONTROL OF FLEXIBLE SPACE MIRRORS USING ADAPTIVE OPTICS AND ROBUST CONTROL

Daniel C. Burtz–Major, United States Air Force
B.S., United States Air Force Academy, 1997
M.E., University of Colorado, 1998
Doctor of Philosophy in Astronautical Engineering–March 2009
Advisor: Brij N. Agrawal, Department of Mechanical and Astronautical Engineering

Future space telescopes will contain lightweight, flexible, segmented mirrors. Traditional control approaches for mirror alignment and shape control may be inadequate due to flexibilities and low natural frequencies. Using adaptive optics for space telescopes presents a possible solution. This research proposes innovative H_∞ robust control techniques for these types of systems. An H_∞ controller is synthesized for a complex analytical model with 997 inputs, 936 outputs, and 332 states. To accomplish this, a new technique for model reduction using Zernike polynomials is developed. The H_∞ controller is able to achieve a minimum 15 Hz control bandwidth. The previous integral controller was unable to meet the 10 Hz bandwidth requirement. The H_∞ design process used is validated on a simpler adaptive optics test bed. The experimental verification also shows that the robust control techniques outperform the classical control techniques in the presence of disturbances.

The significant contributions are a Zernike polynomial method for model reduction, robust controller synthesis for a complex, adaptive-optics analytical model, and experimental verification on an AO test bed. Although the robust control design is more complex, it provides improved performance in the presence of uncertainty in the disturbances and modeling.

KEYWORDS: Robust Control, Adaptive Optics, Segmented Mirrors, Shack-Hartmann Wavefront Sensor, Space Telescopes, H_∞, Flexible Structures

ELECTRICAL ENGINEER

SOURCE LOCALIZATION IN WIRELESS-SENSOR NETWORKS WITH RANDOMLY DISTRIBUTED ELEMENTS UNDER MULTIPATH PROPAGATION CONDITIONS

Georgios Tsivgoulis–Lieutenant Junior Grade, Hellenic Navy
B.S., Hellenic Naval Academy, 2001
Electrical Engineer–March 2009
Master of Science in Electrical Engineering–March 2009
Advisors: Murali Tummala, Department of Electrical and Computer Engineering
John McEachen, Department of Electrical and Computer Engineering
Second Reader: Owens Walker, III, Department of Electrical and Computer Engineering

This thesis proposes a least-squares error estimator for line-of-sight, direction-of-arrival-based localization and a hybrid-source localization scheme that addresses multipath propagation for noncooperative sources using random arrays of wireless sensors. Taking advantage of the dominant reflections, the proposed solution finds the location of a signal source by triangulation using the direction of arrival estimations of both the line-of-sight and the reflected components. It uses a space-division, multiple-access, spread-spectrum-based receiver to generate the direction of arrival estimates. The time difference of arrival information is used to discriminate between the line-of-sight and the non- line-of-sight signals and to associate the incoming multipath signal with the corresponding source and reflector pair. In special cases, the proposed scheme is capable of solving the association problem spatially without the need for time difference of arrival information. Simulation results are included to demonstrate that the proposed scheme provides improved estimates by exploiting the non- line-of-sight information.

KEYWORDS: Wireless Sensor Network, Direction of Arrival, DOA, Random Arrays, Smart Antennas, Time Difference of Arrival, TDOA, Multipath Propagation, Source Localization

MASTER
OF
BUSINESS ADMINISTRATION

MASTER
OF
BUSINESS ADMINISTRATION

NAVAL OFFICER ATTITUDES TOWARD THE "DON'T ASK, DON'T TELL" POLICY

Alfonzo E. Garcia–Lieutenant, United States Navy
Master of Business Administration–March 2009
Advisor: Mark J. Eitelberg, Graduate School of Business and Public Policy
Second Reader: Gail F. Thomas, Graduate School of Business and Public Policy

The U.S. military's "Don't Ask, Don't Tell" (DADT) policy continues to stimulate heated debate over its effectiveness in promoting unit cohesion, good order and discipline, personal privacy, and other organizational objectives. As military leaders focus on recruiting and retaining the highest quality personnel to fight the global war on terrorism, an increasing number of authoritative voices can be heard asking if the DADT policy has become outdated, unnecessary, or simply too costly. The present research seeks to identify trends in the attitudes of Naval officers regarding DADT, which was implemented in 1993 amid significant controversy. The study involves administration of a survey to students at the Naval Postgraduate School (NPS) in November and December 2004. The same survey was administered at NPS in 1994, 1996, and 1999, providing four data points to evaluate trends and changes in attitudes toward DADT. A comparison of responses to the four surveys shows that a majority of officers in 2004 do not support having homosexuals serve openly in the military. As found in two previous surveys, negative views toward the service of homosexuals have declined over time. Additionally, measures of tolerance have increased noticeably over the years since DADT was introduced.

KEYWORDS: Gays in the Military, Homosexuals, Don't Ask, Don't Tell, Personnel Policy, Cost of Homosexual Discharges, Gay Ban

AN ANALYSIS OF TURKEY'S DEFENSE SYSTEMS ACQUISITION POLICY

Goksel Korkmaz–First Lieutenant, Turkish Army
Master of Business Administration–March 2009
Advisor: Lawrence R. Jones, Graduate School of Business and Public Policy
Second Reader: Michael W. Boudreau, Graduate School of Business and Public Policy

The purpose of this MBA thesis is to analyze Turkey's defense systems acquisition policy and its effects on the defense industry over a decade. This thesis provides an overview of the global trends in defense spending and defense markets, explains the defense-industry policies of major players in the defense market, gives an overview of second-tier countries' industry-development models, explains Turkey's defense systems' acquisition policy, and analyzes the policy effects of the defense industry. The thesis concludes with findings and recommended actions for the future.

KEYWORDS: Turkish Defense Industry, Defense Spending, Defense Industry, Offset, Research and Development, Defense Market, Defense Systems Acquisition Policy

MASTER OF SCIENCE

Applied Mathematics
Applied Physics
Computer Science
Contract Management
Defense Analysis
Electrical Engineering
Electronic Warfare Systems Engineering
Engineering Acoustics
Information Operations
Information Systems and Operations
Information Technology Management
Management
Mechanical Engineering
Meteorology
Meteorology and Physical Oceanography
Modeling, Virtual Environments, and Simulation
Operations Research
Physical Oceanography
Software Engineering
Systems Engineering
Systems Engineering Management

MASTER OF SCIENCE
IN
APPLIED MATHEMATICS

SIMULATING TSUNAMIS IN THE INDIAN OCEAN WITH REAL BATHYMETRY BY USING A HIGH-ORDER, TRIANGULAR, DISCONTINUOUS GALERKIN, OCEANIC, SHALLOW-WATER MODEL

Dimitrios Alevras–Lieutenant, Hellenic Navy
B.S., Hellenic Naval Academy, 1994
Master of Science in Meteorology and Physical Oceanography–March 2009
Master of Science in Applied Mathematics–March 2009
Advisors: Francis X. Giraldo, Department of Applied Mathematics
Timour Radko, Department of Oceanography

The discontinuous Galerkin (DG) method has been accepted in the last decade by geoscientists as an important component of geophysical fluid dynamics. The high-order accuracy, geometric flexibility to use unstructured grids, local conservation, and monotonicity properties of the DG method make it a prime candidate for the construction of future oceanic and shallow-water models.

This study focuses on formatting real bathymetry data of the Indian Ocean in order to simulate the propagation stage of the Indian Ocean tsunami that occurred on 26 December, 2004, by using a DG model.

Real measurements are used to validate this simulation. The model results are compared to tide-gauge data from several stations around the Indian Ocean, satellite altimetry, and field measurements. These results show that the model gives accurate estimates of arrival times in distant locations.

KEYWORDS: Tsunami Simulation, Indian Ocean Tsunami 2004, Triangular Discontinuous Galerkin Method, Propagation Stage, Oceanic Shallow Water Model

MODELING A 400-HZ-SIGNAL TRANSMISSION THROUGH THE SOUTH CHINA SEA BASIN

Chris S. Bernotavicius–Lieutenant, United States Navy
B.S., Pennsylvania State University, 2002
Master of Science in Applied Mathematics–March 2009
Advisors: Ching-Sang Chiu, Department of Oceanography
Clyde Scandrett, Department of Applied Mathematics

As part of the Office of Naval Research (ONR)-sponsored Windy Island Soliton Experiment (WISE), two deepwater moorings were placed in the northeastern portion of the South China Sea deep basin to conduct an acoustic-propagation study. For approximately a year, the source and receiver transmitted and received phase-modulated signals to measure the multi-scale variability in the transmission loss induced by the ocean mesoscale variability and the progression of internal tides and waves. A numerical acoustic propagation model based on Hamiltonian ray tracing is utilized to replicate the observed basic arrival structure and transmission loss. Being able to accurately model the basic arrival structure is a necessary first step before modeling the observed variability can be attempted. The comparison of the modeled arrival structure with the actual data is utilized to refine the angular resolution of the ray fan in the model, estimate the geo-acoustic properties of the bottom, and develop transmission loss estimates. Transmission loss measurements from sono-buoy data are used as an independent metric to evaluate the model.

KEYWORDS: Computational Acoustics, South China Sea, Ray Theory, Modeling

THE IMPACTS OF SIGMA COORDINATES ON THE EULER AND NAVIER-STOKES EQUATIONS USING CONTINUOUS GALERKIN METHODS

Sean L. Gibbons–Captain, United States Air Force
B.S., United States Air Force Academy, 2003
Master of Science in Meteorology–March 2009
Master of Science in Applied Mathematics–March 2009
Advisors: Francis X. Giraldo, Department of Applied Mathematics
Tony Eckel, Department of Meteorology

In this thesis, the impacts of transforming the coordinate system of an existing x-z mesoscale model to x-sigma_z are analyzed and discussed as they were observed in three test cases. The cases analyzed are a rising thermal bubble, a linear, hydrostatic mountain, and a linear, non-hydrostatic mountain. The methods are outlined for the transformation of two sets (set 1, the non-conservative form using Exner pressure, momentum, and potential temperature; and set 2, the non-conservative form using density, momentum, and potential temperature) of the x-z Navier-Stokes equations to x-sigma_z and their spatial (Continuous Galerkin) and temporal (Runge-Kutta 35) discretization methods are shown in detail. For all three test cases evaluated, the x-sigma_z models perform worse than their x-z counterparts, yielding higher RMS errors, which are observed predominantly in intensity values and not in placement of steady-state features. Since the models converge to a fairly representative steady-state solution, the results found by this project are promising, even though they indicate that x-sigma_z coordinates are not as accurate or efficient as x-z coordinates. With further fine-tuning of the model environment, these issues could be made minimal enough to warrant their utility with semi-implicit methods.

KEYWORDS: Sigma Coordinates, Continuous Galerkin, Euler Equations, Navier-Stokes Equations, Linear Hydrostatic Mountain, Linear Non-Hydrostatic Mountain, Explicit Time Integration, RK35, Runge-Kutta

MASTER OF SCIENCE
IN
APPLIED PHYSICS

DILUTION OF PRECISION CALCULATION FOR MISSION-PLANNING PURPOSES

Yuen Ming Fatt–Civilian, Republic of Singapore Defense Science and Technology Agency
B.Eng., National University of Singapore, 2003
Master of Science in Mechanical Engineering–March 2009
Master of Science in Applied Physics–March 2009
Advisors: Morris R. Driels, Department of Mechanical and Astronautical Engineering
Richard M. Harkins, Department of Physics

The Joint Munitions Effectiveness Manuals (JMEM) were developed by the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) to provide a set of data and methodologies that would permit a standardized comparison of weapon effectiveness across all service communities. In recent years, the JMEM are being integrated into a single software program that allows users to determine the effectiveness of weapon systems against a specified target irrespective of the weapon-delivery mode. As part of the upgrading effort, this thesis aims to develop a program, written in Visual C++, to automate the calculation of the dilution of precision (DOP) associated with the delivery accuracy of GPS-guided weapon systems. The DOP values generated by the program are compared with those generated by commercial DOP calculation software for validation. The relationship between the vertical DOP and horizontal DOP, as well as the effect of using outdated almanac information to calculate DOP values, is studied. It is found that the loss of one visible satellite could cause the DOP to increase by as much as 38%.

KEYWORDS: JMEM, DOP, GPS, Delivery Accuracy

MASTER OF SCIENCE
IN
COMPUTER SCIENCE

A FRAMEWORK FOR AUTOMATED DIGITAL FORENSIC REPORTING
Paul F. Farrell, Jr.–Lieutenant, United States Navy
B.S., United States Naval Academy, 2002
Master of Science in Computer Science–March 2009
Advisor: Simson L. Garfinkel, Department of Computer Science
Second Reader: Christopher S. Eagle, Department of Computer Science

Forensic analysis is the science of finding, examining, and analyzing evidence in support of law enforcement, regulatory compliance, or information gathering. Today, almost all digital forensic analysis is done by humans, requiring dedicated training and consuming man-hours at a considerable rate. As storage sizes increase and digital forensics gain importance in investigations, the backlog of media requiring human analysis has also increased. This thesis tests today's top-of-the-line commercial and open-source forensic tools with the analysis of a purpose-built, Windows XP computer system containing two users that engage in email, chat, and web browsing. The results of a pilot user study of the PyFlag forensic tool are presented. A technique to use software to conduct a preliminary analysis on media and provide a human-readable report to the examiner is also presented. The goal of the technique is to perform rapid triaging of media and allow the human examiner to better prioritize man-hours towards media with a high return on investment.

KEYWORDS: Forensic, Domex, Pyflag, Automation

PRIVACY FOR MOBILE NETWORKS VIA NETWORK VIRTUALIZATION
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B.E., SUNY Maritime College, 1997
Master of Science in Computer Science–March 2009
Advisors: Gurminder Singh, Department of Computer Science
John H. Gibson, Department of Computer Science

Today, mobile devices have become powerful and ubiquitous. The conveniences afforded by these devices do not come without a cost, however. The use of mobile devices and mobile networks poses a significant risk to privacy. Four privacy requirements for mobile networks are identified: content privacy, identity privacy, location privacy, and authentication. This work focuses on content privacy. Two threats to content privacy are identified: the casual observer and the attacker. This work seeks to provide content privacy protection against the identified threats in mobile networks used by first responders. TwiddleNet, a mobile network designed for the data dissemination requirements of first responders, is used as a platform for implementation.

A network virtualization technique is used in order to provide content privacy protection. This allows TwiddleNet users to share content on a per-group basis among virtual networks of user groups. It is found that this virtualization technique successfully provides content privacy protection from the threat of a casual observer, but not from an attacker. Providing adequate protections from the attacker threat requires more sophisticated measures and is left to future work.

KEYWORDS: Privacy, Mobile Networks, First Responders, Mobile File Sharing, Data Dissemination

A REGULATION SCHEME FOR IMPROVED INNOVATION AND EFFICIENCY IN WIRELESS COMMUNICATIONS

John Richard Kajmowicz–Lieutenant, United States Navy
B.S., United States Naval Academy, 2001
Master of Science in Computer Science–March 2009
Advisor: Bert Lundy, Department of Computer Science
Second Reader: John H. Gibson, Department of Computer Science

Current FCC regulation of the electromagnetic spectrum hinders the growth of wireless-communication technology and fails to make efficient use of an extremely valuable asset. Current policies have failed to keep pace with advancing technology and require a completely new allocation scheme in order to promote growth in the wireless-communications industry. This paper proposes a new allocation scheme for spectrum regulation; the new scheme promotes competition in the marketplace in order to make the most effective use of the physical medium and eliminates unnecessary barriers to entry into the market to promote innovation. Building upon fifty years of property-rights proposals for spectrum allocation, an understanding of the historical events that made regulation a necessity, and the effects of liberalized policies in spectrum as well as other industries led to the creation of an allocation scheme that takes full advantage of the competitive market and minimizes the detrimental effects from antiquated regulation policies. A spectrum lease scheme grants full flexibility of use to leaseholders, yet still maintains minimal governmental control to ensure interference protection.

KEYWORDS: Electromagnetic Spectrum Regulation, Spectrum Allocation, Spectrum Lease, Wireless Communication

DIGITAL AUTHENTICATION FOR OFFICIAL BULK EMAIL

Andrew A. Slack–Lieutenant, United States Navy
B.S., United States Naval Academy, 2002
Master of Science in Computer Science–March 2009
Advisor: Simson L. Garfinkel, Department of Computer Science
Second Reader: Geoffrey Xie, Department of Computer Science

Phishing attacks are becoming more widespread, more sophisticated, and more costly. The Department of Defense is finding that a great number of phishing attacks are specifically directed at military members, attempting to collect information or compromise DoD computers. Criminals are crafting emails that look official and spoofing source addresses that have inherent trust within our organizations. The DoD uses official bulk email as an efficient tool for disseminating information to a wide yet selective audience. The inherent efficiency, captive audience, and trust afforded to official bulk email enables lookalike attacks that mimic bulk email a dangerous attack vector for our adversaries.

Digital authentication can provide a layer of defense to official bulk email that, combined with other defensive countermeasures, will greatly reduce the DoD's vulnerability to this kind of phishing attack. For this reason, the DoD mandates that official emails that contain hyperlinks, attachments, or instructions to recipients be authenticated with a digital signature. Such a signature both authenticates the source of the email and ensures the integrity of the email's contents. This policy, though used at some military installations, is not being applied to some kinds of official bulk email due to administrative roadblocks in obtaining role-based certificates and the difficulty of implementing an authentication policy with legacy email systems.

This thesis identifies the administrative roadblocks to deploying digital authentication solutions within the Department of Defense, explores different technology options for a digital authentication solution for official bulk email, creates a proof-of-concept solution using a Python proxy server and S/MIME, and looks at the most popular mail user agents to determine how they interpret S/MIME digital signatures. Applying digital authentication to official bulk email will close a potentially critical vulnerability in the defense of DoD networks.

KEYWORDS: Digital Authentication, S/MIME, Official Bulk Email, Phishing

SIMULATION-BASED ANALYSIS AND EVALUATION OF TACTICAL, MULTI-HOP, RADIO NETWORKS

Howard D. Smith–Captain, United States Marine Corps
B.S., United States Naval Academy, 2002
Master of Science in Computer Science–March 2009
Advisors: John H. Gibson, Department of Computer Science
Gurminder Singh, Department of Computer Science

For many years, the technologies involved in the newest generations of tactical communication equipment have increased the reliability and security of tactical voice communications from the highest to the lowest levels of combat command. However, the complexities inherent in wireless data networks have prevented the reach of valuable data links from extending efficiently and reliably to the lowest levels of tactical command. This thesis attempts to quantify the performance of tactical data networks using existing technologies and currently deployed, mobile, wireless networking devices by analyzing the results of network simulations involving currently deployed devices. By quantifying these performance metrics and comparing them to previously collected simulation results involving experimental technologies, it is hoped that a mode of comparison can be provided that will accurately reflect the degree to which newer, mobile, wireless networking devices will benefit operational forces.

KEYWORDS: Radio Networks, Multi-Hop Networks, Computer Networks, Tactical Radio Networks, Software-Based Network Simulation, Network Analysis, SINCGARS, EPLRS, Cooperative Diversity, JCSS

MITIGATING DISTRIBUTED DENIAL-OF-SERVICE ATTACKS WITH MULTI-PROTOCOL LABEL SWITCHING WITH TRAFFIC ENGINEERING (MPLS-TE)

Ioannis Vordos–Lieutenant, Hellenic Navy
B.S., Hellenic Naval Academy, 1994
Master of Science in Computer Science–March 2009
Advisor: Geoffrey Xie, Department of Computer Science
Second Reader: John D. Fulp, Department of Computer Science

A denial of service (DoS) occurs when legitimate users are prevented from using a service over a computer network. A distributed denial-of-service (DDoS) attack is a more serious form of DoS in which an attacker uses the combined power of many hosts to flood and exhaust the networking or computing resources of a target server. In recent years, DDoS attacks have become a major threat to both civilian and military networks.

Multi-protocol label switching with traffic engineering (MPLS-TE) is an emerging technology that allows explicit, bandwidth-guaranteed, packet-forwarding paths to be established for different traffic flows. It provides a means for diverting packets of a suspected DDoS attack for analysis and cleaning before forwarding them to the actual destination.

The objective of this research is to implement and evaluate the performance of an MPLS-TE-based solution against DDoS attacks on a realistic test bed network consisting of Cisco routers. The test bed is integrated with Snort, an open-source intrusion-detection system (IDS), to achieve automatic detection and mitigate DDoS attacks. The test-bed network is subject to a series of malicious traffic flows with varying degrees of intensity. The results demonstrate that MPLS-TE is very effective in mitigating such attacks. The overall system-response time and the router CPU loads are comparable to those reported by two former Naval Postgraduate School theses that examined alternative solutions based on BGP black-hole routing.

KEYWORDS: Traffic Engineering, Distributed Denial of Service Attacks, Sinkhole Routing, Black-hole Routing

MASTER OF SCIENCE
IN
CONTRACT MANAGEMENT

A BEHAVIORAL APPROACH TO MEETING CONTINGENCY-CONTRACTING PERSONNEL REQUIREMENTS

Jacob Chieffo–DoD Civilian
Master of Science in Contract Management–March 2009
Advisors: Jeffrey R. Cuskey, Graduate School of Business and Public Policy
Cary Simon, Graduate School of Business and Public Policy

This project describes the incentive processes and programs affecting U.S. Army recruitment outcomes in its attempts to encourage civilian participation in deployments for contingency contracting. Major models of human motivation are analyzed in terms of possibilities for improving the shortage of civilian contingency contracting deployments identified by the *Gansler Report* (October 2007). Issues of incentives, employee needs, motivation, expectations, and deployment concerns are explored to determine how to increase the quantity and quality of deployable civilians. These issues are organized in accordance with Maslow's hierarchy of needs to facilitate a model-based perspective on the deployable contingency-contracting-cadre (DCCC) experience. Recommendations made include: 1) conduct of an official survey to enhance understanding of the target pool, 2) improvements to the DCCC program that exert maximum control over the forces that affect participation (e.g., a direct-support ribbon for participants, DCCC hiring preference points, etc.), and 3) stratifying the DCCC to provide members with a choice of risk levels and associated pay. The researcher also recommends development of distributed contingency-contracting support via a "virtual contingency-contracting cadre," whereby the Army's existing technological investments are leveraged to deliver the work capabilities of numerous personnel without the requirements of a physical presence.

KEYWORDS: Deployable Civilian Contracting Cadre, DCCC, Virtual Contingency Contracting Cadre, VCCC, *Gansler Report*, Recruitment, Motivation, Incentives, Maslow, Herzberg, Vroom, Hierarchy of Needs, Motivation, Hygiene, Expectancy

MASTER OF SCIENCE
IN
DEFENSE ANALYSIS

FOSTERING FOREIGN RELATIONSHIPS AMONG DEPARTMENT OF DEFENSE PERSONNEL

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In various regions around the world, the United States suffers from a significant deficit in operational awareness. In areas like the Middle East, reliable information regarding local attitudes and concerns towards U.S. policy are often unknown or overlooked. U.S. actions and policies can sometimes unintentionally incite anger and resentment among segments of the world community. Additionally, the Department of Defense (DoD) has scarce few individuals who understand the cultural complexities of a given region and who know key persons within. These shortfalls in operational awareness can provide an inadequate understanding of why tensions exist or how to properly address them. As a result, the U.S. is at times surprised by unfavorable events when it should be prepared and have adequate forewarning. To summarize, the U.S. has significant blind spots regarding operational awareness and an insufficient number of persons networked into these obscure regions.

This thesis examines the potential for the DoD to increase operational awareness by fostering foreign relationships between DoD personnel and their foreign counterparts. The thesis further analyzes the value of encouraging U.S. military officers and NCOs to establish, maintain, and further develop personal and professional relationships with foreign military and defense civilians throughout their careers. Based upon an examination of the advantages foreign relationships can bring to secure U.S. policy objectives, courses of action and programs are recommended to maximize the benefits of fostering foreign relationships within the DoD.

KEYWORDS: Foreign Relationships, Relationship Building, Foreign Military Counterparts, Operational Awareness

THE U.S. ARMY CHEMICAL CORPS AND A FUTURE WITHIN THE UNITED STATES AFRICA COMMAND

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The United States Africa Command (USAFRICOM) was established in October 2007 to encompass all U.S. operations on the African continent under one unified command. Several African nations have a history of chemical, biological, radiological, and nuclear operations, while most countries have a history of being used as dumping grounds for hazardous materials and toxic industrial materials. Africa has suffered extreme environmental degradation due to these and other causes. The U.S Army Chemical Corps has increased its capabilities not only to include chemical, biological, radiological, and nuclear operations, but all hazardous material, toxic industrial material, and environmental operations for the U.S. Army. The

chemical corps has also increased capabilities for disaster and crisis response and management since 11 September 2001; some of those capabilities were utilized during Hurricane Katrina.

One of AFRICOM's primary goals is to build partner capacity so that African governments can provide security and respond in times of need. The chemical corps can assist with the realization of these goals.

KEYWORDS: Chemical Corps, CBRNE, Toxic Industrial Material, TIM, Hazardous Material, HAZMAT, AFRICOM, Environment

DRAGON'S CLAWS: THE IMPROVISED, EXPLOSIVE DEVICE AS A WEAPON OF STRATEGIC INFLUENCE

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The purpose of this research is to identify how the improvised, explosive device (IED) is being used as a "weapon of strategic influence" by insurgent groups in Iraq. It is intended to explore how individual IED events, as well as an IED campaign, achieve strategic influence. This thesis examines how immediate and cumulative effects of IED attacks achieve strategic goals politically, economically, socially, and militarily. Particular goals will vary depending on the motivations and objectives of the organization carrying out the attack, so distinctions will be made between Sunni nationalists, Shia nationalists, and the jihadi salafist insurgent groups, such as Al Qaeda in Iraq (AQI). Both terrorism and guerilla warfare are used as insurgent tactics in Iraq—sometimes by the same organization. As a symbolic weapon, the IED is particularly suited as a weapon for both terrorist organizations and insurgents. As a weapon of symbolic violence and an instrument of terror, the IED aids in accomplishing the strategic, political goals of the insurgent groups. IED events have a "target of attack" specifically chosen to reach the audience of the "target of influence." Successful influence of the "target of influence" audience achieves both short- and long-term objectives through immediate and cumulative effects related to the psychological impact of the event(s). The psychological impact the IED achieves outweighs the immediate physical damage. This thesis is not intended to provide a solution for the current IED problem in Iraq or elsewhere; rather, it provides a framework for understanding the IED problem from a strategic perspective.

KEYWORDS: Improvised Explosive Device, IED, Insurgency, Guerrilla Warfare, Counterinsurgency, Strategy, Strategic Influence

THE NATO SPECIAL OPERATIONS FORCES TRANSFORMATION INITIATIVE: OPPORTUNITIES AND CHALLENGES

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Since the end of the Cold War in 1989-1991 NATO has engaged more extensively in expeditionary operations designed to establish and maintain stability in war-torn countries. From the Balkans to Afghanistan, NATO's special operations shortfall has been illuminated. At the Riga Summit in November 2006, NATO leaders decided to develop an alliance special-operations capability. The NATO Special Operations Forces Transformation Initiative (NSTI) was agreed upon as the means by which the allies would improve such capabilities. This thesis investigates the extent to which NATO requires robust special operations capabilities similar to U.S. capabilities in order to respond to current and future threats. Because

threats in the post- 11 September 2001 environment are largely unconventional, NATO must develop a capability that can meet these threats in kind. The need to face and overcome unconventional adversaries is likely to increase as the scope of NATO's military operations extends to areas far from its traditional geopolitical space. This thesis concludes that the NSTI's objective—to enhance the special operations capabilities of the allies—is well-founded and should be properly funded and supported by appropriate command arrangements.

KEYWORDS: NATO, SOF, Special Operations, Asymmetric Threats, Unconventional Warfare, NSTI

MASTER OF SCIENCE
IN
ELECTRICAL ENGINEERING

THE DESIGN AND DEVELOPMENT OF A SINGLE-CHANNEL, ROBUST-SYMMETRICAL-NUMBER-SYSTEM (RSNS) DIRECTION FINDER

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This thesis carries out the design and development of a single-channel, robust-symmetrical-number-system (RSNS), virtual-spacing, direction-finding (DF) system. This is based on previous work on a three-channel, RSNS, virtual-spacing, DF system. Various moduli sets are chosen and run through MATLAB simulations. The results show unacceptably large errors at low signal-to-noise ratios (SNRs) for all sets. Large, dynamic-range, moduli sets yield relatively high errors when compared with the small, dynamic-range, moduli sets. The effect of number of channels is studied and found to be mostly inconsequential for similar resolutions. The simulation includes phase errors from noise and spacing errors. The virtual single-channel concept is integrated into a hardware system. A bench-top setup with amplifier and demodulator cards is constructed. This system is connected to two National Instruments (NI) PXI–5112 cards. LabVIEW software is used to calibrate the demodulator cards and to run the RSNS program.

KEYWORDS: Direction Finding, Robust Symmetrical Number System, Single Channel, Angle-of-Arrival

INEXPENSIVE SOLUTIONS FOR DIRECTION FINDING OF BRIDGE-TO-BRIDGE RADIO TRANSMITTERS USING THE PHASE DIFFERENCE IN THE RECEIVED SIGNAL

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This thesis presents two methods for determining the bearing of a source generating a very high-frequency (VHF) bridge-to-bridge radio transmission. Using principles of interferometry, one can utilize the calculated phase difference between the received signal at multiple antennas to determine the angle-of-arrival of the detected transmission. This translation of phase difference to angle-of-arrival is accomplished using equations based on signal properties and geometry. The theoretical method is shown, proving the relationship between angle-of-arrival and phase difference, as well as how a single platform could accomplish this detection and calculation. Theoretical simulation is accomplished using various simulation tools, including Mathwork's Simulink and Tonne Software's Elsie. Methods are then provided to detect the phase difference using both a series of analog mixers and filters, as well as digitally, using software radio. Analog filters are built and tested to determine the relationship between phase difference and voltage output. Software programs are written for a software-defined radio implementing digital filtering to verify the analog performance. Results and accuracy are shown based on initial testing.

KEYWORDS: VHF, Bridge-to-Bridge, Interferometry, Direction-Finding, Software–Defined Radio

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FILE TRANSFER WITH ERASURE CODING OVER WIRELESS-SENSOR NETWORKS

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In order to provide a step towards the goal of passing TCP/IP traffic across wireless-sensor networks, a method for file transfer utilizing forward error correction (FEC) is studied. Previous work in the area of terminal communication across the sensor network is expanded upon to include file transfer in order to provide a more capable channel and a basis for testing the performance obtained through erasure coding. The results of the FEC implementation are examined using multiple sensor network configurations. The study concludes with recommendations for continued work towards developing tunneled TCP/IP data transfer across wireless-sensor networks.

KEYWORDS: Wireless Sensor Networks, File Transfer, Forward Error Correction, Wireless Communications

THREE-DIMENSIONAL FEATURE RECONSTRUCTION WITH DUAL, FORWARD-LOOKING SONARS FOR UNMANNED-UNDERWATER-VEHICLE NAVIGATION

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Unmanned, underwater vehicles frequently rely on two-dimensional sensors for information about their surroundings. These sensors do not provide adequate information for obstacle avoidance in cluttered maritime environments. To address that issue, a three-dimensional reconstruction of the environment utilizing occupancy grids and a prototype forward-looking sonar is considered. Providing the vehicle with three-dimensional views of the environment allows for optimal route planning and an increase in successful missions in complex environments.

KEYWORDS: Unmanned Vehicles, UUV, Occupancy Grid, Three Dimensional Reconstruction, Three Dimensional Map

SOURCE LOCALIZATION IN WIRELESS-SENSOR NETWORKS WITH RANDOMLY DISTRIBUTED ELEMENTS UNDER MULTIPATH PROPAGATION CONDITIONS

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This thesis proposes a least-squares error estimator for line-of-sight, direction of arrival-based localization and a hybrid-source localization scheme that addresses multipath propagation for non-cooperative sources using random arrays of wireless sensors. Taking advantage of the dominant reflections, the proposed solution finds the location of a signal source by triangulation using the direction of arrival estimations of both the line-of-sight and the reflected components. It uses a space-division, multiple-access, spread spectrum-based receiver to generate the direction of arrival estimates. The time difference of arrival information is used to discriminate between the line-of-sight and the non-line-of-sight signals and to associate the incoming multipath signal with the corresponding source and reflector pair. In special cases, the proposed scheme is capable of solving the association problem spatially without the need for time

difference of arrival information. Simulation results are included to demonstrate that the proposed scheme provides improved estimates by exploiting the non-line-of-sight information.

KEYWORDS: Wireless Sensor Network, Direction of Arrival, DOA, Random Arrays, Smart Antennas, Time Difference of Arrival, TDOA, Multipath Propagation, Source Localization

FIELD-PROGRAMMABLE GATE ARRAY (FPGA)-BASED, SOFTWARE-DEFINED RADIO (SDR) DESIGN

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Wideband-communications systems that were built using field-programmable gate array (FPGA)-based, software-defined radio (SDR) designs exist today. Despite the inherent advantages of these systems, some are functionally restricted by limited output bandwidth. The goal of this thesis is to mitigate the restrictions imposed on such designs. This is accomplished by designing an FPGA-based SDR that can compress sampled intermediate-frequency (IF) signals. The compression scheme used in the final design is based on flexible, operator-defined, time-frequency bins and independent energy thresholds for each bin. The thesis presents basic design concepts that influenced the development process, the final design implementation created using Xilinx's System Generator software, and the tests used to verify the final design's functional capabilities.

KEYWORDS: Software Defined Radio, SDR, Field Programmable Gate Array, FPGA, Signal Compression

MASTER OF SCIENCE
IN
ELECTRONIC WARFARE
SYSTEMS ENGINEERING

RF-STEALTH (OR LOW-OBSERVABLE) AND COUNTER– RF-STEALTH TECHNOLOGIES: IMPLICATIONS OF COUNTER– RF-STEALTH SOLUTIONS FOR THE TURKISH AIR FORCE

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This thesis examines the evolution of stealth (with a focus on RF low-observables), the counter technologies to detect RF stealth (or low-observable) aircraft, the reasons an air force needs such technologies, advantages and disadvantages of these assets, and the latest developments in this area.

While low-observable technologies have been around for nearly half a century, they are still secret in nature and sensitive. This poses problems when conducting unclassified research in this field; nevertheless, this thesis addresses technological details that enable the operational use of stealth assets by examining open sources.

Counter-stealth technologies are increasingly relevant, and research in this field is ongoing around the world. This thesis provides information about these efforts and discusses the possible solutions that can be applied to a complex, air-defense network.

Finally, this thesis focuses on the Turkish air force's possible counter– RF-stealth requirements and the evaluation for the desired solution.

KEYWORDS: Stealth Technology, Low Observables, Stealth Advantages, Radar Cross Section Reduction, RCS Reduction, Radar Absorbent Material, RAM, Counter-stealth Technologies, HF Radars, Bi-Static Radars, Passive Radars, Networked Radars, Electronic Warfare

MASTER OF SCIENCE
IN
ENGINEERING ACOUSTICS

AUTOMATED DETECTION OF A CROSSING CONTACT BASED ON ITS DOPPLER SHIFT

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The trade-off between false alarm and detection probability is a fundamental challenge in the automated detection of contacts in passive sonar systems. A common approach is the application of high-gain processing followed by successive classification criteria. Most classification schemes (e.g., matching of signatures) are complex and tailored to specific target types. By contrast, the Doppler effect is readily observed in all contacts with discrete tonals and relative velocity to the receiver. This thesis demonstrates that the Doppler effect can be exploited to improve the detection process by filtering out contacts that do not exhibit these characteristics. Cross-correlation (matched filtering) of contact LOFAR grams with templates generated in situ with Doppler compression/dilation is used to achieve this. Velocity information and the range of the closest point of Approach (CPA) are estimated in the process. A detection algorithm is developed in MATLAB, and the radiated acoustic signatures of overflying airplanes are recorded at a ground station. In the analysis of six propeller and four jet airplanes, the program successfully identifies the passage of all six propeller airplanes with four incidences of false alarm, due in one case to a jet airplane. Velocity and range estimates are also within expected values.

KEYWORDS: Automated Passive Target Detection, Doppler Shift, Cross Correlation, Matched Filter, Velocity Estimation, CPA Range Estimation

UNDERSEA NODE LOCALIZATION USING NODE-TO-NODE ACOUSTIC RANGES IN A DISTRIBUTED SEAWEB NETWORK

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Seaweb is a wide-area network interconnecting a set of distributed, underwater nodes through the use of a DSP-based, acoustic-communications modem at each node and through-water digital acoustic links between neighboring nodes. As a byproduct of Seaweb communications, the distances between neighboring nodes are obtained from the round-trip, acoustic travel-time measurements. If the network is deployed in an ad-hoc distribution, or if an established network is disturbed, the locations of the nodes are unknown to the operator. This thesis uses the node-to-node ranges, which have been compiled at the designated master node, as input to an algorithm for estimating the relative locations of all nodes. Synthetic network geometries serve to evaluate the algorithm with perfect ranges and with imperfect ranges and/or incomplete data. Seaweb networks deployed at sea are the final test of the algorithm.

KEYWORDS: Underwater Acoustics, Seaweb, Localization, Difference Linearization

MASTER OF SCIENCE
IN
INFORMATION OPERATIONS

HIZBULLAH'S CULTURE WARS: UNDERSTANDING HIZBULLAH THROUGH SOCIAL-MOVEMENT THEORY AND ITS MEDIA USAGE

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This thesis uses social-movement theory to examine how Hizbullah frames its message to its various target audiences. The growth and influence of different Hizbullah media over the past two decades suggest that Hizbullah has been successful in shaping a popular message both inside Lebanon and in the larger Arab world. Hizbullah's successful media campaign has paralleled its growth as perhaps the single most important political party in Lebanon today. The "terrorist" frame that the U.S. government applies to Hizbullah appears inconsistent with the broad political, economic, social, and media work of this largely Shia organization.

Message framing is compared between al-Manar, Hizbullah's flagship media, and Al-Jazeera on the same set of stories from the 2006 Lebanon War and the 2008 Gaza War, both to analyze the internal framing of issues by Hizbullah and to compare it to the leading Arabic media today. Al-Manar frames its message largely in polarizing hero-victim terms, while Al-Jazeera is far more factual and professional in its presentation of the same stories. Using heroic types of frames has both benefits and disadvantages for Hizbullah's information strategy.

KEYWORDS: Hizbullah, al-Manar, al-Jazeera, Social Movement Theory, Framing

MASTER OF SCIENCE
IN
INFORMATION SYSTEMS AND OPERATIONS

AN ANALYSIS OF TRUST IN DECEPTION OPERATIONS
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This study explores the concept of trust and its relevance to deception operations. It proposes that trust is a belief or characteristic that can be exploited or undermined to achieve a desired objective. By using a trust framework to analyze several case studies in deception, this paper examines how the deception-target's beliefs and preconceptions affect the success of the deception and the impact or consequences of exploiting or undermining trust. Finally, conclusions are drawn from this analysis that may be helpful in the analysis of other deception operations and in future deception planning.

KEYWORDS: Trust, Trust Theory, Deception Operations, Military Deception, MILDEC, Deception

THE SIX PILLARS OF INFLUENCE: HOW INSURGENT ORGANIZATIONS MANIPULATE GOVERNMENTS, POPULATIONS, AND THEIR OPERATIVES
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This thesis is a study of insurgent use of six basic principles of human persuasion and influence. These principles are put forth by Robert B. Cialdini in his work, *Influence: The Psychology of Persuasion*. The principles of influence put forth in Cialdini's work are reciprocation, commitment and consistency, social proof, liking, authority, and scarcity. While past studies have sought to explain the manner in which insurgencies gain influence, there has not been a thorough study conducted using this particular framework. This thesis first provides an overview of Cialdini's principles of influence, examining each of the six principles. Next, it provides an historical look at six different insurgencies—the Viet Cong, the Mau Mau Uprising, the Irish Republican Army, the Bolshevik Revolution, the 26th of July Movement (Cuba), and EOKA (Cyprus)—and examines the manner with which insurgents influence internal and external audiences. Next, a comparative case analysis examines the relative success of these influence tactics (or a combination thereof) and the interrelations and relative importance of each of the six principles based on the study of the six insurgencies. Finally, this thesis recommends possible applications of the study in conducting counterinsurgency.

KEYWORDS: Influence, Persuasion, Reciprocation, Commitment, Authority, Cialdini, Viet Cong, Provisional Irish Republican Army, Mau Mau, Russian Revolution, Bolshevik Party, Cuban Revolution, 26th of July Movement, EOKA, Cyprus, Kenya

A BUSINESS-CASE ANALYSIS OF THE ONE BOX, ONE WIRE (OB1) JOINT COMBINED TECHNOLOGY DEMONSTRATION

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The One Box, One Wire (OB1) Joint Combined Technology Demonstration (JCTD) is a United States Central Command (USCENTCOM) initiative that has been approved by Congress for an FY2009 rolling start. The primary goal of the JCTD program is to demonstrate, operationally assess, and transition capability solutions and innovative concepts to address the joint, coalition, and interagency operational gaps and shortfalls in meeting the needs of the warfighter. Since inception in 1995, the Advanced Concept Technology Demonstration (ACTD) program, and now the JCTD program, has deployed critically needed warfighting solutions to every major combatant-command theater.

The OB1 JCTD is an initiative designed to transform the existing Department of Defense air-gapped networks (NIPR, SIPR, etc.) to an environment that allows the user to access all networks from a single PC terminal while still preserving the separation and security of data flows.

This thesis is a business-case analysis of the cost of implementing and sustaining the OB1 JCTD as compared to the current Department of Defense multi-network infrastructure. This thesis addresses the question of whether converting the existing military network infrastructure into OB1 is financially feasible. This thesis concentrates specifically on the OB JCTD initiative.

KEYWORDS: Business Case Analysis, BCA, One Box One Wire, OB1, Joint Combined Technology Demonstration, JCTD, Advanced Concept Technology Demonstration, ACTD, Special Operation Forces Cross Domain Services Architecture and System Enhancements, SOFCASE, High Assurance Platform, HAP, Classification Stateless Trusted Environment, CSTE, Coalition Secure Management and Operations System, COSMOS, Advanced Concept Technology Demonstration, ACTD, Agile Coalition Environment, ACE, Department of Defense Intelligence Information Systems, DoDIIS, DTW, NetTop

MASTER OF SCIENCE
IN
INFORMATION TECHNOLOGY MANAGEMENT

THE TECHNOLOGIES AND PRINCIPLES NEEDED FOR THE POWERING OF REMOTE NODES IN AN INTEROPERABILITY NETWORK

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This thesis investigates the various power-system solutions and options available for affording remote network nodes autonomy. The approach taken is to first identify the particulars of a network that affect the power needs and requirements of remote network nodes. Secondly, this thesis examines candidates, and combinations of those candidates, for fulfilling the power needs of the remote nodes. Additionally, monitoring and management of power sources are studied. The purpose and focus of the work contained in this research is to provide insight into how best to incorporate remote-node power systems into the design of an interoperability communications network.

Communications and the ability to exchange data are heavily depended upon today, particularly in the event of a disaster. In times of need, where rural regions do not possess the necessary infrastructure, the dependency is significant. A solution to this need is being filled by developing communication and interoperability networks.

In both the situation of rural application and regions suffering from disaster, the use of network equipment is often limited by the means available to electrically power the equipment. This issue can be further complicated in situations requiring that equipment be positioned in locations absent from network operators. Remote network node, power-system solutions require methods and technologies to allow these nodes some independence in terms of IT power requirements.

KEYWORDS: Power Generation, Remote Network Node, Interoperability Network, Electric Generator, Wind Power, Solar Power, Photovoltaic, Thermoelectric, Energy Storage, Fuel Cell, Hybrid Power, Power Monitoring, Power Management

MANAGING COMMUNICATIONS WITH EXPERTS IN GEOGRAPHICALLY DISTRIBUTED COLLABORATIVE NETWORKS

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The idea of communication through collaboration is not new; however, the need to collaborate efficiently with subject-matter experts has become essential towards establishing a competitive advantage among individuals, groups, and organizations. As networks expand, organizations flatten, and globalization continues, geographically distributed collaborative networks have become pervasive and are more common as a way of conducting daily business and resolving problems. Developing the ability to effectively manage communications with experts, through a collaboration strategy designed to maximize this new environment, has rapidly become a critical skill set. While people are becoming inundated with collaboration technologies, the assurance needed that strong connections are formed, regardless of the technological tools utilized, requires an understanding of social science fundamentals. This further requires an understanding of network-science fundamentals. Understanding the intricacies involved in managing communications with experts in a geographically distributed collaborative network is extremely important but under-researched. This thesis combines social and network-science fundamentals to develop a strategy for managing communications with experts in geographically distributed collaborative networks.

KEYWORDS: Collaboration, Communications, Communities of Practice, Experts, Social Networking

AN ANALYSIS OF MAINTENANCE-MANPOWER STRUCTURES FOR LAND-BASED NAVAL AIRCRAFT USING A KNOWLEDGE-VALUE-ADDED APPROACH

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In June 2008, lieutenant commanders Shane Tallant, Scott Hedrick, and Michael Martin conducted thesis research entitled "Analysis of Contractor Logistic Support for the P-8 Poseidon Aircraft." Their manpower analysis showed a large percentage of costs related specifically to type-duty assignments. The objective of this thesis is to use a knowledge-value-added analysis of the manpower structure of an existing, operational, aviation community in order to determine the most beneficial manpower structure for the maintenance personnel in that community. The methodology used during this research is applicable to any aviation community.

KEYWORDS: Knowledge Value Added, Type-Duty, Navy Standard Workweek, Maintenance Manpower

TESTING AND EVALUATION OF LOW-LIGHT SENSORS TO ENHANCE INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE (ISR) AND REAL-TIME SITUATIONAL AWARENESS

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Video cameras have increased in usefulness specific to military applications over the course of the past four decades, providing remotely controlled and viewed, high-definition, color images in both day and night conditions; they are ideal for defense applications, including force protection, critical asset monitoring, and perimeter surveillance. This is a result of many advances in technology, including production of high-definition sensors, development of new video-compression algorithms and IP capabilities, auto-tracking features, image stabilization, etc. Furthermore, the evolution of wireless-networking technology and capability provides new practical options to gather intelligence, surveillance, and reconnaissance (ISR) information.

The goal of this thesis is to test and evaluate performance and suitability of low-light cameras in a variety of operating environments and as a possible alternative to more expensive infrared, thermal, or night-vision applications. Understanding the true capabilities and limitations of the ALAN camera and its applicability to a wireless network by using an aerial vehicle will allow appropriate application and operation for military purposes.

KEYWORDS: Sensor, Low Light Camera, ALAN, All Light All Night, ISR, Intelligence, Surveillance, Reconnaissance

MAXIMIZING SITUATIONAL AWARENESS: IMPROVING SITUATIONAL AWARENESS WITH GLOBAL POSITIONING SYSTEM DATA IN THE MARITIME ENVIRONMENT

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The U.S. Coast Guard mission is to daily conduct law enforcement in the dynamic and challenging maritime environment. Rapid advances in technology have the potential to dramatically improve the organization's capacity to conduct this mission. The ability to track and monitor suspect vessels and the law-enforcement personnel that board them is a critical next step in the evolution of maritime interdiction. With the development of the global-positioning system (GPS) and the downward trend of GPS receiver costs and form size, it is now possible to integrate positioning technology with collaborative software tools and wireless networking. The power of collaborative tools and real-time positioning data offers the potential to deliver an entirely new and unique level of situational awareness to the law-enforcement teams on the water, as well as the command-and-control structure shoreside. No longer does VHF radio need to be the sole form of communication between operational personnel and their commands. This thesis discusses the specific methods available for tagging and tracking individuals and vessels and explores the challenges and feasibility of deploying these technologies in the maritime environment.

KEYWORDS: Global Positioning System, GPS, GPS Denial, Situational Awareness, Maritime Domain Awareness

A FEASIBILITY STUDY OF NETWORK-OPERATIONS CENTER COLLABORATION TO IMPROVE APPLICATION LAYER PERFORMANCE

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Network-centric warfare seeks to improve the link between the shooter and sensor networks, enabling direct access to pertinent information and a shorter decision loop with improved operational capabilities. The sensor–shooter network is often conceptualized in two network models: centralized and decentralized. Centralized networks can provide robust management of network resources, but potentially lengthen the decision process while information is routed through distant nodes or becomes delayed in lengthy queues. Comparably, decentralized networks can potentially speed up the decision process by direct access to information. Decentralized networking does not promote efficient management of network resources since all users are able talk to each other and overload the network. To overcome the high utilization of resources, network operations centers (NOCs) on decentralized networks can manage resources by collaborating with other NOCs. A NOC can be any device that monitors, reports, and manages resources. NOC-to-NOC collaboration would allow for greater efficiency using network resources by allowing for prioritization and protection of critical services determined by the operational user. To allow effective collaboration and management, the information that needs to be monitored and how to manage it must be defined. The information set and usage is defined in this thesis.

KEYWORDS: Network Operations Centers, Collaboration, Task Force ODIN, Peer to Peer, Network Centric Warfare, Network Management, Application Layer Performance

EXPLORING THE LACK OF INTEROPERABILITY OF DATABASES WITHIN THE DEPARTMENT OF HOMELAND SECURITY'S INTERAGENCY ENVIRONMENT CONCERNING MARITIME PORT SECURITY

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Federal agencies that are within the Department of Homeland Security have many missions in support of the security of the United States. One mission concurrent with this thesis topic is maritime-interdiction operations, which protect America's maritime borders from all intrusions by halting the flow of illegal drugs, aliens, and contraband into the United States through maritime routes. All government agencies within the Department of Homeland Security are continuing to focus their efforts on sharing critical data to improve their situational awareness of command and control, to make quicker decisions, and to collaborate with remote experts in support of another possible terrorist attack. Unfortunately, this effort is being accomplished without the foresight of interoperability of existing databases throughout the interagency environment within the Department of Homeland Security. The lack of interoperability of these databases continues to be a major issue for the security and safety of the nation's maritime ports. This thesis discusses this lack of interoperability between federal, state, and local law-enforcement agencies. The need and urgency to coordinate these vital databases into one unified, decentralized network—to store and retrieve critical information to protect maritime ports of entry, when needed, to protect the nation from any possible future threats that may harm our nation—is also stressed.

KEYWORDS: Interoperability, HSIN, Department of Homeland Security, Command and Control, Situational Awareness, Maritime Port Security, USCG, CBP

APPLYING MODERN PORTFOLIO THEORY AND THE CAPITAL-ASSET PRICING MODEL TO THE DEPARTMENT OF DEFENSE'S INFORMATION TECHNOLOGY INVESTMENTS

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Program managers (PMs) throughout the Department of Defense were directed by the DoD chief information officer to manage information technology (IT) investments as portfolios (to include mission areas, sub-portfolios, and components) within the DoD enterprise. Managing portfolios of capabilities aligns IT with the overall needs of the warfighter, as well as the intelligence and business activities that support the warfighter. This thesis provides the detailed steps that PMs and program executive officers (PEOs) should follow to closely manage their IT portfolios using the concepts described within Harry Markowitz' modern portfolio theory. The first section provides a demonstration of allocating revenue generated by a fictitious, large corporation to the various sub-corporate levels and then applying knowledge-value-added (KVA) analysis to calculate a return on investment. The foundation of KVA analysis is that each sub-process's output must be represented in common units of change; a price per unit of output is generated to allocate both cost and revenue at the sub-process level. The final section applies a similar KVA analysis to the Naval Cryptologic Carry-On Program (CCOP) systems to provide a public-sector example.

KEYWORDS: CAPM, Capital Asset Pricing Model, KVA, Knowledge Value Added, Real Options, ROI, Return on Investment, MPT, Modern Portfolio Theory

CONTINGENCY CONTRACTING AND THE IT MANAGER: TODAY'S CHALLENGES AND FUTURE IMPLICATIONS

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This qualitative case study examines the relationship between information-technology (IT) management and contractor management within the context of the Iraq and Afghanistan contingencies. The case study presents a historical context of United States defense contracting along with another to illustrate the chronological advances made in information-technology management. Finally, the case study presents a description of the defense contingency, along with a multiple-source characterization of contingency contracting.

The case study collects data to support research using the survey technique of individual interviews with subjects possessing on-hand experience dealing with contracted personnel providing IT services throughout the Iraq and Afghanistan contingencies. The case study analyzes data utilizing the pattern-matching methodology to determine the level of efficiency and effectiveness of the management of contractor personnel when performed by IT managers. After determining whether performance was effective or efficient, the case study identifies factors that act as levers to either improve or deter effective

contract management of IT managers. Finally, the case study makes recommendations for future research topics affecting the levers presented.

KEYWORDS: Contingency, Contracting, Information Technology, Information Technology Management, Defense Contracting, Case Study, Interview, Survey, Procurement, Contract Management, Contractor, Iraq, Army, Gansler

SEQUENTIAL PATTERN DETECTION AND TIME-SERIES MODELS FOR PREDICTING IMPROVISED-EXPLOSIVE-DEVICE ATTACKS

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Improvised, explosive devices (IEDs) are a significant threat to coalition forces. Defeating IEDs as weapons of strategic influence has become a major objective of combatant commanders and their respective joint task forces. This thesis attempts to identify new approaches that can help operational forces mitigate the risk of IED attacks by identifying common sequences of events that occur before an IED attack and forecasting the number of attacks in the immediate future. Using the CARMA association-rules algorithm on historical data of religious, political, and IED-attack events, a model is developed to explore commonly occurring sequences of events leading to an insurgency IED attack and to predict events that are likely to occur given the sequence observed to date. Time-series models are also generated to identify trends and relationships that can be helpful in forecasting future, monthly IED attacks based upon previous, actual, historical attacks. The identified sequences and forecasts could be used to help plan troop movements, rotations, and force levels, and to allocate limited resources to address imminent threats.

KEYWORDS: Sequential Pattern Detection, Time Series, Predicting IED Attacks, Data Mining

CURRENT FEDERAL IDENTITY MANAGEMENT AND THE DYNAMIC-SIGNATURE BIOMETRICS OPTION

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Although identity management (IDM) and biometrics have been engrained in the business practices of private and commercial organizations for decades, the U.S. government (USG) and the Department of Defense (DoD) have only truly started to institute a holistic IDM enterprise within the last decade. More specifically, the DoD has sharpened the focus on leveraging biometrics since the beginning of the war on terrorism. The operational capability to distinguish red forces or gray forces from blue forces is now a common daily occurrence. Regardless of the theater or area of operations, U.S. forces are utilizing biometrics to identify enemies.

In the next phase of implementing a comprehensive IDM enterprise, the DoD is crafting new IDM policies, procedures, and systems that will distinguish between various levels of access and security controls among blue forces. Blue force IDM architectures are required by specific USG and DoD policies to enforce standardization in policy and application across all federal agencies to improve and synchronize their business practices. With many agencies crafting their own version of the future, a basic understanding of current IDM and biometric requirements, as well as potential biometric resources, is necessary to move forward.

KEYWORDS: Biometrics, Biometrics Task Force, Dynamic Signature, Identity Management, IdM Enterprise

MASTER OF SCIENCE
IN
MANAGEMENT

AN ANALYSIS OF THE EFFECT OF THE GLOBAL WAR ON TERRORISM ON THE RETENTION OF GRADUATES OF THE U.S. NAVAL ACADEMY

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This thesis analyzes the effect of the global war on terrorism (GWOT) on the retention behavior of United States Naval Academy (USNA) graduate Navy and Marine Corps junior officers one year after their minimum service obligation (MSO).

The data used for the analyses covers cohorts from 1990 to 2007. Three logistic-regression models are constructed to estimate the impact of increasing operational tempo due to the GWOT. Three separate models are created for the Marine Corps to measure the effect of hostile deployments. The models include demographic, service, and deployment variables, as well as a difference-in-difference estimator to capture the effect of the GWOT.

Deployments either before or after the GWOT had a positive effect on the retention behavior for both the Navy and the Marine Corps. However, a hostile deployment decreased the likelihood to retain for the Marine Corps.

KEYWORDS: United States Naval Academy, Retention, Naval Officer, Marine Corps Officer, Global War on Terror, Navy, Marine Corps, Hostile, Hostile Deployment

THE BRAZILIAN AIR FORCE HEALTH SYSTEM: WORKFORCE NEEDS ESTIMATION USING SYSTEM DYNAMICS

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The demand for physician manpower is a function of the demand on the entire health system, which varies as a function of user demographic characteristics. The recruit quantity and the departure behavior over time cause oscillations in the actual quantity and in the services system quality. These aspects are related to each other and exogenous systems lead the health system to behave as a complex structure. This thesis defines a preliminary system-dynamics model that analyzes and forecasts the Brazilian air force health system's physician demand and its estimated effect on the required number of medical professionals.

KEYWORDS: Manpower Forecasting, Brazilian Air Force Health System, System Dynamics, Systems Thinking, Modeling and Simulation, Multivariate Analysis

IMPROVED SCREENING FOR NAVY ENLISTMENT

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This thesis analyzes the effect of selected demographic characteristics on first-term enlisted attrition from the U.S. Navy. The characteristics include age, marital status, dependency status, gender, race, Armed Forces Qualification Test (AFQT) score, and education credential. The analysis draws from a Defense Manpower Data Center file containing Navy enlisted cohorts of recruits from fiscal years 1999 through 2003. Probit regression models are constructed using these data to identify differences in the attrition likelihood of recruits who possess the selected characteristics. Results show that the current educational-tier system is flawed with respect to education credential assignment and attrition predictability. The data also reveal that different factors correlate with attrition during the first ninety days (or less) of service and attrition occurring later. Finally, dependency status of single sailors is found to be the single strongest predictor of attrition once education and aptitude (AFQT score) are controlled.

The Navy uses AFQT score and the Educational Tier to determine enlistment eligibility. This thesis presents matrices for screening applicants based on education credential, AFQT score, age, marital status, and dependency status, with the intent of more accurately predicting first-term attrition.

KEYWORDS: Attrition, Education Credentials, Tier System, Recruiting, Eligibility, Screening

PREDICTING THE EFFECT OF MARINE CORPS SELECTIVE-REENLISTMENT BONUSES IN THE POST 9/11 ERA: INTEGRATING THE EFFECTS OF DEPLOYMENT TEMPO

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This thesis explores the predictive effects of the Marine Corps Selective Reenlistment Bonus (SRB) on first-term retention while controlling for varying levels of deployment tempo. In order to successfully predict reenlistment decisions in the current era, the model must control for conditions that affect a Marine's choice to reenlist, none being more influential than deployments to Operation Iraqi/Enduring Freedom. Adding deployment tempo variables to the logit prediction model enables Marine Corps manpower planners to properly account for changing conditions in the "long war."

The results of this analysis find that the increased deployment tempo in recent years has had a negative affect on reenlistments. To counter this effect, the Marine Corps has steadily increased its SRB budget and subsequent SRB offers to all Marines. In order to improve the accuracy of reenlistment predictions, this thesis estimates a model with alternative indicators of deployment tempo. The model developed is parsimonious, yet predicts accurately. Validation results show that if the model were utilized to predict fiscal year 2007 reenlistment rates, it would have average prediction errors of 12% for the twenty-seven high-density MOSs, who make up nearly 61% of the first-term population.

KEYWORDS: Selective Reenlistment Bonuses, SRBs, Deployment Tempo, Retention, Reenlistment

THE EFFECT OF MOS SELECTION AND PLACEMENT ON THE RETENTION OF MARINE COMPANY-GRADE OFFICERS

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The purpose of this thesis is to assess the relationships between MOS placement and retention of company-grade officers. An officer-data file from the Center of Naval Analyses is augmented with Total Force Data Warehouse data to create the primary analysis data file. The data set contains officer cohorts from 1994–1999 and 2001–2002, a total of 5,922 newly commissioned officers. Several five- and six-year multivariate retention models are estimated to test the sensitivity of the retention effect of MOS preferences and to determine if including prior enlisted Marines in the data affects the basic effects. The objective is to isolate the effects on junior-officer retention of MOS placement outside of an officer's top three MOS preferences.

The findings indicate that MOS placement has a strong negative effect on the retention of NROTC, PLC, and OCC graduates. Among demographic groups, black and Asian officers are more likely to retain than white officers. Significant differences in retention do not exist between men and women; however, when prior-enlisted officers are included in the samples, the sizes of the key coefficients fall in magnitude. The findings for the six-year model indicate no significant effects of MOS placement, gender, or race, with and without prior enlistees, on the retention decisions of officers who graduate from the U.S. Naval Academy.

KEYWORDS: Marine Corps, USMC, The Basic School, TBS, MOS Preferences, MOS Assignment, Officer Career Paths, Alternative Career Paths, Naval Postgraduate School, NPS, Special Education Program, SEP, IAOP, FAO, RAO

A REFINED MARINE CORPS CONTRACT-SUPPLY MODEL FOR HIGH-QUALITY MALE ENLISTMENTS AT THE RECRUITING SUBSTATION LEVEL

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The objective of this research is to further develop and refine an existing model for forecasting the supply of high-quality male contracts at the recruiting substation level for the Marine Corps. Additional variables that were excluded in the previous model are researched and incorporated to provide a more realistic scenario for the Marine Corps Recruiting Command. This follow-on research is necessary because of rising accession missions and increasing recruiter levels. The goal is that this forecasting information will facilitate recruiting efforts as end-strength increases over the course of the next two years.

KEYWORDS: Recruiting, Recruiters, Contract Supply, Forecasting, USMC, Marine Corps Recruiting Command, MCRC

VARIABILITY OF VALUATION OF NON-MONETARY INCENTIVES: MOTIVATING AND IMPLEMENTING THE COMBINATORIAL RETENTION AUCTION MECHANISM

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This thesis explores the concept of preference variability relative to non-monetary and monetary incentives in the combinatorial retention auction mechanism (CRAM). CRAM offers a mix of monetary and non-monetary incentives to encourage retention behavior. Recent research demonstrated the utility of non-monetary incentives as part of a military retention program. While CRAM was shown to cost effectively motivate retention, variability in valuation of non-monetary incentives as part of CRAM introduces complexity in eliciting preferences to implement the model. Making certain complexity-decreasing assumptions regarding the personal valuation of incentives potentially affects the model cost and retention outcomes. These assumptions could potentially increase costs and retain the "wrong" sailors.

This thesis examines an operational version of the CRAM, which assumes additive personal preferences across combinations of non-monetary incentives to decrease the complexity of the model. The outcomes of this "simplified" model are compared to the "more complex" previous research findings. The simplified CRAM model continues to produce cost savings, with no significant changes to the mix of personnel retained. Overall, results of the CRAM, assuming additive personal preferences across combinations of non-monetary incentives, are not significantly different than the more complex model.

KEYWORDS: Military Retention Auction, Manpower, Variability, Compensation, Preference Elicitation, Non-Monetary Incentives

A STUDY OF ENLISTMENT TEST SCORES AND OTHER ATTRITION FACTORS FROM THE NAVY'S DELAYED-ENTRY PROGRAM

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This study focuses on the effects of AFQT percentile score and age on Navy delayed-entry program (DEP) attrition. The data used in the study were collected from fiscal years 1999 through 2008 and were provided by the Defense Manpower Data Center (DMDC). Men and women are analyzed separately because of historic differences in attrition by gender and sample size. Regression analysis is conducted using three different models, each with age and AFQT score as the primary variables of interest. In the first model, with the use of an interaction variable, the effect of AFQT score on DEP attrition depends upon the age of the individual. The second and third models employ only binary variables to estimate a linear probability model (LPM). The results of this study indicate that the effect of AFQT score on DEP attrition depends on the age of the individual. Generally, as a person gets older, he or she is more likely to attrite from the DEP. Males generally have lower attrition rates than females. High-school graduates make up the majority of DEP applicants and generally have lower attrition rates than persons holding other educational credentials.

KEYWORDS: Navy, Delayed Entry Program, DEP, Attrition, AFQT, Age, Enlisted, Recruit, Eligibility, Matrix

FORECASTING MARINE CORPS ENLISTED ATTRITION THROUGH PARAMETRIC MODELING

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The Marine Corps, like any organization with a large workforce, must accurately monitor and, more importantly, predict the transition rates among personnel entering and exiting the enlisted and officer ranks. This emphasis is even more appropriate given that the Marine Corps has been authorized to increase the current authorized end-strength by 13,000 personnel from fiscal year 2008 to fiscal year 2010. The purpose of this thesis is to apply parametric modeling (specifically survival analysis) to historical data sets of enlisted personnel in order develop a more efficient forecasting tool for military planners. It is the intent to include in the model those characteristics that significantly influence attrition behavior, and to aggregate these findings to an efficient, yet effective, forecasting model. Therefore, this thesis analyzes the interaction of time, individual characteristics, and those causal attributes that determine whether a Marine completes his or her contracted service. The current forecasting method used by the Marine Corps forecasts enlisted attrition annually. This thesis study forecasts enlisted attrition monthly within occupational field. Hence, the data is structured to provide this depth of analysis. In comparison to the current forecasting method of exponential smoothing, this study finds that the use of survival analysis could be beneficial to not only forecast attrition, but also provide a descriptive assessment of attrition rates amongst occupation fields without loss of information due to averaging or weighting probabilities.

KEYWORDS: Survival Analysis, Gompertz Model, NEAS Loss, Attrition

AN ANALYSIS OF THE CIVILIANIZATION OF THE MINISTRY OF NATIONAL DEFENSE IN THE REPUBLIC OF KOREA IN SUPPORT OF DEFENSE REFORM 2020

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The purpose of this study is to investigate the feasibility of the civilianization plan of the Ministry of National Defense (MND) in the Republic of Korea (ROK). The MND developed a plan to construct modernized military power and to operate it efficiently and effectively. The MND promotes the plan to increase the civilian personnel ratio inside headquarters by 2009, which is relatively faster than other main policies. Moreover, the environment inside and outside the organization is not mature enough to drive this policy quickly. There are also widely differing points of view on this policy between military members and civilian personnel. Defense ministries in other countries, especially the United States, have well-developed systems to educate and recruit civilian experts. By doing so, they have attained a high level of civilian participation while minimizing possible problems. Many people in the organization worry about this plan because there are not enough organizations and systems to educate and train civilian defense experts. Although the direct comparison of workforce capability between military members and civilian personnel is limited, there are advantages and disadvantages that can be obtained through civilianization. Therefore, it is necessary to change this policy to a long-term one with more elaborate procedures.

KEYWORDS: Civilianization, Cost Analysis, Ministry of National Defense, Department of Defense, Defense Reform, Civilian Personnel, Pay and Compensation

THE EFFECT OF AVIATION-SELECTION TEST-BATTERY WAIVERS ON MARINE STUDENT-AVIATOR ATTRITION

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This study examines the effect of aviation-selection test-battery (ASTB) waivers on Marine student-aviator attrition. The first objective is to determine whether Marine student-aviators who are granted an ASTB waiver are significantly more likely to attrite for performance or motivational reasons. The second objective is to determine the effect on attrition of changing the Marine Corps' ASTB minimum-score-waiver policy to allow more than ten percent of aviators to enroll annually with a test-score waiver. The study uses logit models to estimate the effect of ASTB waivers on attrition and to simulate the effect of changing the Marine Corps' waiver policy. The results suggest that student-pilots with a waiver for an ASTB score of 4/5 are significantly more likely to attrite. Additionally, student-NFOs with a waiver, regardless of their test score, are significantly more likely to attrite. The simulation shows a small, positive effect on attrition of increasing the Marine Corps' current waiver rate. This study recommends that the Marine Corps maintain its current policy and that further research be conducted to account for student-aviator attrition during introductory flight screening and to determine the effect of changing the Marine Corps' waiver policy on recruiting costs, flight-school training costs, and minority representation.

KEYWORDS: Aviation Selection Test Battery, Minimum Score Waivers, Flight School Attrition, Marine Corps Student-Aviators

AN EXAMINATION OF AFLOAT TRAINING-OFFICER MILESTONES IN SUPPORT OF TRAINING-OFFICER CAREER PROGRESSION

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Currently, the HR-community billet structure does not support assignment to any CRUDES or LHD platforms. This study is a qualitative analysis of the professional education and training necessary to prepare 120X officers for training-officer (TO) billets afloat. It evaluates what combination of formal and informal training is appropriate to assume TO billets. As 120X officers become manpower personnel training and education and subject-matter experts, additional, specific training may be required when fulfilling challenging billets, such as the CVN TO billet. Any additional training must be identified and implemented to any deficiency. Inconsistencies between operational requirements and training programs need to be addressed in order to minimize any possible negative impact on returns. This research examines formal training and its effectiveness on the 120X community; on-the-job training and its effectiveness, which often augments formal training; and unrestricted line officers who laterally transfer into the human-resources community, bringing valued competencies to the 120X community and the Navy human-capital enterprise.

KEYWORDS: Training Officer, HR Community, Milestones, Lateral Transfer

A COMPARATIVE ANALYSIS OF THE ARMY MQ-8B FIRE SCOUT VERTICAL-TAKEOFF, UNMANNED, AERIAL VEHICLE (VTUAV) AND THE NAVY MQ-8B MANPOWER AND TRAINING REQUIREMENTS

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The recent increased urgency to combat terrorism and asymmetric threats, combined with an environment in which field troops are forced to operate has created a unique demand for nonstandard warfighting capabilities. Beginning in 2004, the U.S. Navy, in a joint effort with the Army, began testing and evaluating the Northrop Grumman MQ-8B Fire Scout Vertical-Takeoff, Unmanned, Aerial Vehicle (VTUAV). This platform has shown very promising early results in testing and is slated for implementation on the Navy's newest littoral combat ship (LCS).

A manpower analysis of the Fire Scout MQ-8B is conducted to identify requirements applicable to operating the platform aboard an LCS. Current Army MQ-8B manning is described and used to compute a baseline model to determine the best mix of manpower requirements needed to implement Fire Scout at sea. Accurate identification of manpower requirements and training for Fire Scout operators, technicians, and support personnel will eventually diminish reliance on civilian contractors and provide an opportunity for joint military operability. The Army MQ-8B Fire Scout training program is analyzed to compare the suitability and feasibility of Navy training for operators and technicians. Currently, there is no Navy training program in place to train Fire Scout operators and technicians to support the LCS.

KEYWORDS: Unmanned Aerial Vehicles, UAV, VTUAV, Vertical Takeoff Unmanned Aerial Vehicle, Fire Scout, RQ-8B, LCS, Littoral Combat Ship, KSA, Knowledge Skills and Abilities, Personnel, Manning, Manpower

THE NEXT BEST ALTERNATIVE TO AN IDEAL RECRUIT: ATTRITION CHARACTERISTICS OF RECRUITS WITH WAIVERS AND LOW EDUCATIONAL CREDENTIALS IN THE ARMY

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The supply of high-quality recruits is limited and the military services are facing a diminishing recruiting market. Under these constraints, it is important to identify which groups of recruits are the next best alternatives to an ideal recruit. This research examines the attrition rates of recruits with less than ideal qualifications, including recruits enlisted with waivers, without high-school diplomas, or with low AFQT scores in the U.S. Army. The secondary focus of this study is to analyze the effect of a conduct or drug waiver on attrition due to behavioral or drug problems. Data from the Defense Manpower Data Center, consisting of all enlisted accessions for U.S. Army between fiscal year 2000 and fiscal year 2006, is used. Multivariate data analysis is employed to analyze both attrition and unsuitability attrition.

The study reveals that educational credentials have a decreasing effect on both attrition and unsuitability attrition. Conduct waivers have a decreasing effect on early attrition, but an increasing effect on first-term attrition. Unsuitability attrition rates of recruits with conduct waivers are higher for all subcategories with drug waivers leading. Recruits with medical waivers are more likely to attrite in all attrition points, but this effect is likely to be offset by higher educational standards. They are also less likely to attrite for unsuitability reasons.

KEYWORDS: Educational Credentials, High Quality Recruits, Ideal, Less-Than Ideal, Conduct, Moral, Drug, Waivers, Attrition, Misconduct, Manpower, Recruiting

MASTER OF SCIENCE
IN
MECHANICAL ENGINEERING

A STUDY OF LOAD TRANSFER AND FRACTURE ON COMPOSITE TO METAL-WIRE JOINTS

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In order to connect a composite structure to a metallic structure, a hybrid composite/metal-wire laminate is considered. Such a hybrid laminate raises a question of interface strength between the composite layer and the metal-wire layer, and what kind of lay-up configuration would be best. In order to answer this question, the following three joints are considered: butt, overlap, and modified-wire-end-shape joint. The goal of this research is to numerically determine which joint would be the strongest based on its components of fracture toughness under various loading conditions, such as tension, shear, and bending. A defect is included between and parallel to the interfaces to simulate a crack in the critical regions of the models. The crack growth, due to interlaminar tension and/or sliding, is analyzed using the crack-closure technique. Finite element formulations in this research are carried out using ANSYS finite-element software.

KEYWORDS: Butt Joint, Overlap Joint, Modified-Wire-End-Shape Joint, Finite Element Method, Energy Release Rate, Virtual Crack Closure Method, Fracture Toughness, Ansys

PHYSICS-BASED MODELING AND ASSESSMENT OF MOBILE LANDING-PLATFORM SYSTEM DESIGN

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In this thesis, the overall throughput rate is examined from a container ship servicing the sea base to the objective ashore, with attention paid to the mobile landing platform. An initial study is conducted using a variety of air and surface connectors considering the various technologies being developed for the sea base concept and the use of a T-AKE class ship acting as a warehouse. A second study is conducted taking the results from the initial study and inputting it into Excel, with output to determine the maximum number of surface connectors that could be employed to maximize the logistical throughput without incurring a wait time. A third study is conducted, using a code developed in MATLAB, to determine the maximum number of surface connectors that could be employed to maximize the logistical throughput without incurring a wait time. The number of loading spots versus the amount of deck space available for storage of cargo is calculated for the various cases. The surface connectors considered are the landing-craft, air cushioned (LCAC), the next-generation landing-craft, air cushioned (LCAC(X)), and the sea-base connector transformable craft (T–Craft). Finally, a separate logistics simulation developed by Professor Gordis is used to compare the different connectors, the effect of increasing the available deck space on the mobile landing platform, and the effects of technologies that would increase the connector load times.

KEYWORDS: Sea Base, Mobile Landing Platform, Logistical Connector, Fleet Force Sustainment

DILUTION OF PRECISION (DOP) CALCULATION FOR MISSION-PLANNING PURPOSES

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The Joint Munitions Effectiveness Manuals (JMEM) were developed by the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) to provide a set of data and methodologies that would permit a standardized comparison of weapon effectiveness across all service communities. In recent years, the JMEM are being integrated into a single software program that allows users to determine the effectiveness of weapon systems against a specified target irrespective of the weapon-delivery mode. As part of the upgrading effort, this thesis aims to develop a program, written in Visual C++, to automate the calculation of the dilution of precision (DOP) associated with the delivery accuracy of GPS-guided weapon systems. The DOP values generated by the program are compared with those generated by commercial DOP calculation software for validation. The relationship between the vertical DOP and horizontal DOP, as well as the effect of using outdated almanac information to calculate DOP values, is studied. It is found that the loss of one visible satellite could cause the DOP to increase by as much as 38%.

KEYWORDS: JMEM, DOP, GPS, Delivery Accuracy

MASTER OF SCIENCE
IN
METEOROLOGY

POTENTIAL VORTICITY ANALYSIS OF LOW-LEVEL THUNDERSTORM DYNAMICS IN AN IDEALIZED SUPERCELL SIMULATION

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In this thesis, a synoptic-scale diagnostic tool is applied to storm-scale features to determine the feasibility of smaller-scale application. Potential vorticity inversion makes it possible to retrieve the wind and mass fields from the three-dimensional distribution of potential vorticity based on a balance constraint. The potential vorticity inversion performed follows that of the nonlinear balance inversion developed by Davis and Emanuel (1991). The advanced weather research and forecast (ARW) model is used to produce an idealized splitting supercell. The distribution of potential vorticity is derived from the wind and thermodynamic model variables. The balanced wind and mass fields are then calculated based on the nonlinear balance constraint and qualitatively compared to those patterns seen in other observation and numerical thunderstorm studies. The findings show promise that PV diagnostics can be applied to thunderstorm dynamics. Qualitative results show that appropriate, smaller-scale, atmospheric flows can be represented by balanced flow calculated from the potential vorticity inversion. Refinements are necessary to improve the quantitative accuracy of this technique.

KEYWORDS: Potential Vorticity, Severe Local Storms, Thunderstorm Dynamics, Weather Research and Forecasting Model, WRF, Advanced WRF, ARW

THE IMPACTS OF SIGMA COORDINATES ON EULER AND NAVIER-STOKES EQUATIONS USING CONTINUOUS GALERKIN METHODS

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In this thesis, the impacts of transforming the coordinate system of an existing x-z mesoscale model to x-sigma_z are analyzed and discussed as they were observed in three test cases. The cases analyzed are a rising thermal bubble, a linear, hydrostatic mountain, and a linear, non-hydrostatic mountain. The methods are outlined for the transformation of two sets (set 1, the non-conservative form using Exner pressure, momentum, and potential temperature; and set 2, the non-conservative form using density, momentum, and potential temperature) of the x-z Navier-Stokes equations to x-sigma_z and their spatial (Continuous Galerkin) and temporal (Runge-Kutta 35) discretization methods are shown in detail. For all three test cases evaluated, the x-sigma_z models perform worse than their x-z counterparts, yielding higher RMS errors, which are observed predominantly in intensity values and not in placement of steady-state features. Since the models converge to a fairly representative steady-state solution, the results found by this project are promising, even though they indicate that x-sigma_z coordinates are not as accurate or efficient as x-z coordinates. With further fine-tuning of the model environment, these issues could be made minimal enough to warrant their utility with semi-implicit methods.

KEYWORDS: Sigma Coordinates, Continuous Galerkin, Euler Equations, Navier-Stokes Equations, Linear Hydrostatic Mountain, Linear Non-Hydrostatic Mountain, Explicit Time Integration, RK35, Runge-Kutta

DIURNAL, SEA-BREEZE-DRIVEN, CROSS-SHORE EXCHANGE ON THE INNER SHELF IN CENTRAL MONTEREY BAY

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Cross-shore exchange on the inner shelf has important impacts on the ecosystem, transporting heat, nutrients, pollutants, and phytoplankton between the midshelf and the surf zone. The effects of a strong (cross-shore wind stress, $\tau sx > 0.05Pa$), diurnal (7-25 hrs), sea breeze on cross-shore exchange at Marina, Monterey Bay, California, is investigated using two years of continuous winds, waves, and ocean velocities. Surface-wind stress has spectral peaks at 1, 2, and 3 cpd, and the diurnal wind variability is greater than 50%. Similar spectral, energetic peaks also occur with waves and currents. During sea-breeze relaxation ($-0.05Pa < \tau sx < 0.05Pa$), a background, wave-driven, inner-shelf, undertow profile exists, which is equal and opposite to the Lagrangian Stokes drift, resulting in a net-zero Lagrangian transport at depth. In the presence of a sea breeze ($\tau sx > 0.05Pa$), a uniform offshore profile develops that is different from the background undertow profile, allowing cross-shore Lagrangian transport to develop, while including the Lagrangian Stokes drift. The seasonality of waves and winds modifies the diurnal sea-breeze impact. Therefore, material is hypothesized to incrementally move onshore near the surface and offshore near the sea bed only during sea-breeze events.

KEYWORDS: Sea Breeze, Inner Shelf, Cross-Shelf Transport, Monterey Bay

A VERIFICATION OF THE COAMPS-TC MODEL PREDICTIONS OF TYPHOON NURI (2008)

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The objective of this thesis is to examine the predictions of the COAMPS-TC model for Typhoon Nuri during the THORPEX Pacific Asian Regional Campaign (T-PARC) and the Tropical Cyclone Structure 2008 (TCS-08) experiment that took place from August to October 2008 in the western North Pacific. This case study on Typhoon Nuri examines the dynamic and thermodynamic structure changes of this tropical cyclone, including the intensity, track, radar reflectivity, and azimuthally averaged plots of tangential winds, radial winds, vertical velocity, and cloud water. The lifecycle of Typhoon Nuri is broken down into the formation, intensification, and decay stages, and one model run from each stage is evaluated. The minimum sea-level pressure and maximum winds are found for each of the three grids of the COAMPS-TC model and the high-resolution (T799) ECMWF model and are compared to the Joint Typhoon Warning Center best-track values. The forecast tracks from both models are examined and compared to the best-track values. Overall, the models do the best during the intensification stage. Lastly, the aircraft data are compared to the initial conditions for the model, and it is concluded that this aspect is the major source of forecast error.

KEYWORDS: Typhoon Nuri, COAMPS-TC Model, THORPEX Asian Pacific Regional Campaign, Tropical Cyclone Structure 2008, TCS 2008, Western North Pacific Typhoons, ECMWF

COASTAL JETS AND THEIR INTERACTIONS ALONG THE CENTRAL CALIFORNIA COASTLINE

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This thesis research focuses on the cause of strong southerly winds around the Monterey Peninsula, particularly on the effects of winter storms that produce strong southerly winds. The high-wind events from 2005 through 2008 were analyzed. During this period, sixteen cases were identified that met the criteria of high winds around the Monterey Peninsula. From these cases, three were chosen to complete a detailed analysis of the three storm structures.

Results from this research suggest new approaches that improve the prediction of the southerly coastal jet on the California coast that can be accurately predicted. A sea-level pressure tool can be used to identify how strong a wind speed gust will be at the Monterey Airport for one storm, and that the Froude number can determine the timing of the onset of winds at the Monterey Airport. When the flow is blocked (Froude number less than unity), weak winds are observed at the Monterey Airport, while stronger winds are seen at the Monterey Airport when the flow is unblocked.

KEYWORDS: Coastal Jet, Froude Number, Gap Flow, Barrier Jets, Monterey, Windstorm

Z-M IN LIGHTNING FORECASTING

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Frozen hydrometeors are required for a storm to produce lightning. Previous research has made strong correlations between ice mass and lightning flash rate and -density. This study attempts to correlate ice mass to lightning potential. Operational interest is centered at Cape Canaveral Air Force Station/Kennedy Space Center, where accurate weather forecasting is vital to mission requirements, resource protection, and personnel safety.

Four pulse storms are chosen for the study, occurring on 2 June 2004, 26 June 2004, 6 June 2005, and 15 June 2005. These storms were known lightning producers. The ice mass of each storm is calculated using a new, layered approach called layered, vertically-integrated, frozen content (LVIF). The LVIF technique uses radar reflectivity (Z) to calculate ice content (M) at six temperature layers between -10°C and -40°C, with each layer 5°C. This Z-M relationship is analyzed for lightning potential. The results indicate that there is no correlation between LVIF and lightning potential.

KEYWORDS: Lightning, Ice Content, Forecasting, Thunderstorms

A STATISTICAL–DYNAMICAL APPROACH TO INTRASEASONAL PREDICTION OF TROPICAL CYCLOGENESIS IN THE WESTERN NORTH PACIFIC

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David W. Meyer, Department of Operations Research

A combined statistical–dynamical prediction scheme is developed to predict the probability of tropical cyclone (TC) formation at daily, 2.5° horizontal resolution across the western North Pacific at intra-seasonal lead times. Through examination of previous research and our own analysis, five variables are chosen to represent the favorability of the climate system to support tropical cyclogenesis. These so-called large-scale environmental factors (LSEFs) include low-level relative vorticity, sea-surface temperature, vertical wind shear, Coriolis, and upper-level divergence.

Logistic regression is employed to generate a statistical model representing the probability of TC formation at every grid point based on these LSEFs. Thorough verification of zero-lead hindcasts reveals that this model displays skill and potential value for risk-adverse customers. In particular, these hindcasts have a positive Brier skill-score of 0.03 and a skillful relative operating characteristic skill-score of 0.68. The fully coupled, one-tier NCEP climate-forecast system is used as the dynamical model with which to forecast the LSEFs and, in turn, force the regression model. A series of individual TC case studies are conducted to demonstrate the predictive potential, at intra-seasonal leads, of the statistical–dynamical method. Lastly, the applicability of intra-seasonal forecasts to military planning is investigated.

KEYWORDS: Tropical Cyclones, Western North Pacific, Tropical Cyclogenesis, Intraseasonal Forecasting, Smart Climatology, Tropical Climatology, Long-Range Forecast, Long-Range Weather Support, Tropical Genesis Parameters, NCEP Climate Forecast System

THE USE OF CONDITIONAL AND POTENTIAL INSTABILITY AXES FOR SEVERE WEATHER FORECASTING

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In this thesis, an innovative approach to severe weather forecasting is used, employing traditional forecast parameters. The maximum theta-e (potential instability) in the lowest 300 mb and the deep-layer lapse rate (conditional instability) fields are two commonly used forecast parameters for severe weather forecasting; and the ridges of these fields, or more specifically, the ridge intersections, are hypothesized to indicate regions for enhanced severe convection. In addition, the sharpness of these ridge axes may correlate to an increase in severe potential. To test this theory, a mathematical formula is devised to quantitatively assess ridge strength. Then, using theta-e, lapse rate and their respective ridge strengths as predictors, a linear discriminate analysis is performed on dependent and independent datasets from spring 2008. Severe probabilistic forecasts are produced using the discriminate analysis and verified using two independent methods. Skill metrics calculated for the forecasts determine that there is significant positive skill of the forecast technique. As a side note, this research attempts to determine the wavelength features (meso–α to meso–β) that record the highest level of skill using this method. No significant difference is noted in the different wavelength feature forecasts, possibly due to the verification method.

KEYWORDS: Severe Weather, Conditional Instability, Potential Instability, Discriminate Analysis, Theta-e, Lapse Rate, Ridge Axis Formula

THE IMPACT OF AEROSOLS ON SCENE COLLECTION AND SCENE CORRECTION

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Airborne aerosols contaminate satellite imagery, making it difficult for analysts to characterize surface targets. The amount of contamination is due to aerosol loading, best quantified by aerosol optical depth (AOD). Level 2 AERONET data provides "ground truth" AOD measurements. Unfortunately, targets are not likely to be near an AERONET station. This thesis examines two methods of quantifying AOD in lieu of AERONET data: moderate-resolution imaging spectroradiometer (MODIS) AOD retrievals and Navy aerosol analysis and prediction system (NAAPS) AOD forecasts (with MODIS data assimilation). Over the Persian Gulf and Japan, MODIS accurately retrieved AOD at 0.55μm wavelength. MODIS may have accurately retrieved AOD over Korea, but uncertainty in the retrieval was high due to a small sample size. Over West Africa, MODIS underestimated AOD. Over the Persian Gulf and Japan, NAAPS accurately estimated AOD at 0.55μm. Over Korea, the model displayed mixed results. Finally, over West Africa, NAAPS tended to underestimate AOD.

KEYWORDS: Aerosol Optical Depth, AERONET, MODIS, NAAPS, Radiance, Surface Reflectance

REMOTE DETECTION OF CLOUD-BASE HEIGHTS USING CLOUDSAT AND CALIPSO

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This thesis study focuses on the evaluation of cloud-base height from a pair of space-based remote-sensing systems. The first satellite, CloudSat, is a 94-GHz cloud profiling radar (CPR) utilizing a wavelength capable of penetrating thick hydrometeor layers. The second satellite, the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite, is an active lidar designed to detect optically thin hydrometeor layers. The 2B-GEOPROF-Lidar product combines data from these two synergistic observing platforms to provide a complete profile of the vertical structure of clouds in the atmosphere. For this research, 2B-GEOPROF-Lidar cloud-base height measurements are validated against cloud-base height measurements from a combined suite of ground-based sensors at four Department of Energy atmospheric-radiation measurement (ARM) sites. Cloud-base height measurements validated within 480 meters, the vertical resolution of the CPR, are deemed accurate assessments. Differences in cloud-base height exceeding 720 meters are labeled as significant outliers. Significant outliers are further investigated to find trends in radar reflectivity and cloud mask data from CloudSat and total attenuated backscatter from CALIPSO. The combined CloudSat/CALIPSO cloud-base assessment proves accurate in 73% of the cases studied.

KEYWORDS: Cloud Base Height, CloudSat, CALIPSO, Remote Sensing, Cloud Radar, Lidar

MASTER OF SCIENCE
IN
METEOROLOGY AND PHYSICAL OCEANOGRAPHY

SIMULATING TSUNAMIS IN THE INDIAN OCEAN WITH REAL BATHYMETRY BY USING A HIGH-ORDER, TRIANGULAR, DISCONTINUOUS GALERKIN, OCEANIC, SHALLOW-WATER MODEL

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The discontinuous Galerkin (DG) method has been accepted in the last decade by geoscientists as an important component of geophysical fluid dynamics. The high-order accuracy, geometric flexibility to use unstructured grids, local conservation, and monotonicity properties of the DG method make it a prime candidate for the construction of future oceanic and shallow-water models.

This study focuses on formatting real bathymetry data of the Indian Ocean in order to simulate the propagation stage of the Indian Ocean tsunami that occurred on 26 December 2004 by using a DG model.

Real measurements are used to validate this simulation. The model results are compared to tide-gauge data from several stations around the Indian Ocean, satellite altimetry, and field measurements. These results show that the model gives accurate estimates of arrival times in distant locations.

KEYWORDS: Tsunami Simulation, Indian Ocean Tsunami 2004, Triangular Discontinuous Galerkin Method, Propagation Stage, Oceanic Shallow Water Model

DEPTH DERIVATION FROM THE WORLDVIEW-2 SATELLITE USING HYPERSPECTRAL IMAGERY

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The Worldview-2 satellite, scheduled for launch in 2009, will have a multispectral sensor with several additional spectral bands not available on current multispectral sensors. This research investigates the use of the additional, yellow, spectral band to derive bathymetry. A hyperspectral image acquired from the AVIRIS sensor is used as a substitute image for the Worldview-2 multispectral sensor. The image is processed using the Stumpf, et al., (2003) "ratio method" to determine bathymetry in a section of Kaneohe Bay, Hawaii. Depths acquired using the green/blue, yellow/green, and yellow/blue ratios are compared to ground truth bathymetry derived from a digital nautical chart. The results indicate that using the Stumpf, et al., (2003) algorithm with yellow/green and yellow/blue ratios improves the accuracy of derived depths compared to depths derived using the green/blue ratio, especially in shallow waters.

KEYWORDS: Remote Sensing, Hyperspectral, Multispectral, Bathymetry, Worldview-2, Quickbird

CHARACTERIZATION OF EPISODIC, RIP-CURRENT PULSATIONS IN THE INNER SHELF DURING RIP-CURRENT EXPERIMENT (RCEX) 2007

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As the Navy thrusts operations into global brown-water environments, a more complete understanding of the phenomena ships and swimmers will encounter in nearshore regions is necessary. Rip currents remain infamous and important characteristics of the nearshore environment. These events not only impinge upon swimmers' safety, but may play a key role in transferring water, containing nutrients, biologics, and even shore- and ship-borne pollution, between the surf zone and open ocean environments. Vertical and temporal behavior of rip currents outside the surf zone is poorly understood due to a paucity of comprehensive observations. Observations of two upward-looking acoustic Doppler current profilers (ADCP) deployed in 3 m and 5 m water depth within a rip current (nominally 1.0 and 1.2 surf-zone widths from the shoreline, respectively) were obtained during April–May 2008 as part of the rip-current experiment (RCEX) at Sand City, Monterey Bay, California. The ADCPs sampled continuously at 1 Hz. Energetic, seaward-directed, episodic pulses associated with the rip current obtained velocities up to 0.5 m/s with a frequency of occurrence varying from 1–15 times a day depending upon coincident wave and tidal conditions. Vertical variations of the episodic, rip-current pulsations ranged from depth-uniform to surface-dominated. Cross-rotary analysis and complex correlation, performed in the vertical to describe rotational behavior and temporal lags, show rip currents in the inner shelf exhibit more rotation, up to 20 degrees in both CW and CCW directions, than in the surf zone. High coherence is limited to near-surface levels in the inner shelf, versus more depth-uniform values in the surf zone. Mean vertical profiles show these phenomena exhibit significant shear and structure.

KEYWORDS: Rip Currents, Rip Current Structure, Episodic Rip Current Pulsations, Inner Shelf, RCEX 2007, Surf Zone Volume Exchange, Sand City, Nearshore Circulation

AN INVESTIGATION OF PANCHROMATIC SATELLITE IMAGERY-SENSOR LOW BIAS IN SHADOW-METHOD, AEROSOL-OPTICAL-DEPTH RETRIEVAL

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A technique known as the "shadow method" was developed for calculating aerosol optical depths by measuring the radiance difference between shaded and unshaded regions in high-resolution satellite imagery by Vincent (2006). Previous research investigated use of the shadow method in regions of dust obscuration using buildings and clouds as shadow generation sources and a variety of background surfaces. A recurring low bias was seen when using the shadow method with the QuickBird satellite's panchromatic sensor. QuickBird and WorldView1 commercial imagery is examined using the shadow method at several sites co-located with AERONET observations sites. The results show that low bias is not attributed to sensor calibration, processing methods of the imagery, or water-vapor content. The most likely source of low bias is the region-of-interest selection geometry within the shadow regions.

KEYWORDS: Aerosol Optical Depth Retrieval, AOD, High-Resolution Commercial Imagery, QuickBird, WorldView1, Shadow Method, Cloud Shadows

THE LARGE-SCALE ENVIRONMENT DURING THE TROPICAL CYCLONE STRUCTURE 2008 AND THORPEX PACIFIC ASIAN REGIONAL CAMPAIGN

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This study examines the effects of large-scale circulations (e.g., ENSO, Pacific decadal oscillation (PDO), Indian Ocean dipole (IOD), Antarctic oscillation (AAO), and monsoon trough (MT)) on tropical cyclone (TC) activity in the western North Pacific (WNP) during May through October from 1979 to 2008. The specific objective is to understand how these circulations affected the THORPEX/T-PARC/TCS-08 experiments held during August to October 2008. Pivot tables and t-tests are used to analyze the effects of combinations of these circulations on TC activity. Composites of OLR and 850- and 200-hPa winds are constructed to emphasize significant differences between phases of large-scale circulations and combinations. Differences between opposing phases are also analyzed. A statistically significant relationship exists between ENSO phase and TC activity in terms of accumulated cyclone-energy (ACE) values and super-typhoon (STY) numbers. The relationship is less significant, but substantial, for the PDO signal analyzed. However, IOD and AAO have even less significance. The MT signal is significant in the ACE values, but less significant in the STY numbers. The conclusions are that ENSO strongly moderates TC activity and numbers of the most intense TCs in the WNP, while PDO, IOD, and AAO merely reinforce a positive or negative phase of the ENSO circulations. The MT signal has significance on TC activity, but little effect on STY numbers.

KEYWORDS: Large-Scale Tropical Circulations, Tropical Cyclones, ENSO, Pacific Decadal Oscillation, Indian Ocean Dipole, Antarctic Oscillation, Monsoon Trough, Interannual Variability

MASTER OF SCIENCE
IN
MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

IMPROVED USABILITY OF LOCOMOTION DEVICES USING HUMAN-CENTRIC TAXONOMY

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Second Reader: CDR Joe Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)

This thesis investigates how early taxonomies of locomotion fail to provide a framework comprehensive enough to facilitate usable locomotion devices due to a failure in understanding the human component in interaction. It then proposes an alternative, human-centric taxonomy for locomotion that grounds itself on the physiological, physical, and extra-physical cues the human body is capable of providing, rather than only on the input that existing interaction devices are capable of receiving. Through the realization that interaction begins with the human, not the machine, this thesis is able to determine a cue from the body that is able to provide enough information for use by an algorithm to recognize, with a minimal amount of sensors and associated hardware, walking and running forward, side-stepping, back-stepping, and jumping. This thesis develops and performs initial tests on a fully implemented locomotion device using input from two inertial sensors on the legs, in conjunction with the locomotion-recognition algorithm for use in any commercial, off-the-shelf video game for PCs that use keystrokes for locomotion input.

KEYWORDS: Locomotion, Virtual Walking, Taxonomy, Virtual Environments

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MASTER OF SCIENCE
IN
OPERATIONS RESEARCH

MODELING ORDNANCE MOVEMENTS INTO THE ASIAN PACIFIC THEATER

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Second Reader: Keebom Kang, Graduate School of Business and Public Policy

This thesis explores the capabilities of ordnance movements into the Asian Pacific theater. Through simulation, logistics modeling, and data analysis, this thesis identifies critical factors and capabilities that are important to the effective movement of ordnance by combat logistics ships through Guam during a military contingency. The experimental design incorporates the effects of competing requirements on the ordnance resupply process in Guam. The objective is to facilitate an evaluation of systems, identify possible improvements to fully exploit capabilities, and gain insights into the process methodology. Results indicate that the inclusion of competing requirements to the system degrades both the auxiliary dry cargo/ammunition ship (T-AKE) service level and the overall throughput of the system by nearly 25%. Analysis of critical factors contributing to this degradation indicates that the T-AKE arrival cycle is the largest contributing factor to the system's effectiveness. The results also indicate that competition is a contributor to the effects on the system, but never the most influential aspect, and the decision of where to process ordnance is significant for the best-performing scenarios in the experiments. Lastly, the analysis clearly shows that improving the system's performance is not dependent on the distance of ordnance-storage facilities from the wharf.

KEYWORDS: Ordnance Movement, Asian Pacific Theater, T-AKE, ARENA, Entity-Based Modeling, SEED Center, Logistics, Simulation, Design of Experiments

NAVY OFFICER MANPOWER OPTIMIZATION INCORPORATING BUDGETARY CONSTRAINTS

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Every two years, the Chief of Naval Operations is responsible for submitting a program-objectives memorandum to the Secretary of the Navy for further review and inclusion in the president's two-year budget input to Congress. The Chief of Naval Personnel's strategic-resourcing branch is challenged with building a manpower budget program that both meets the budget limitations set forth by Congress and the manning requirement choices made by Navy leadership. This thesis develops the requirements-driven, cost-based, manpower optimization (RCMOP) model. RCMOP is a linear optimization program designed to guide monthly values for officer inventory, promotions, accessions, designator transfers, and forced and natural losses. RCMOP's goal consists of minimizing a weighted-penalty function of unmet manpower requirements while meeting the Navy's fiscal constraints over a two-year horizon. Implementation of the test scenario shows that resulting costs fall within 10% of predicted budget estimates, and promotion metrics approximate the values expected by law and policy. The model also indicates a need to increase total OCS accessions (by 11%) with respected to projected values, as well as the percentage of 1000-coded billets filled by staff and fleet support officers.

KEYWORDS: Navy Officer Manpower Optimization, Linear Programming, Program Objective Memorandum, POM, Manpower Optimization, Manpower Modeling

A COST ANALYSIS OF ELECTRIC-GRID ENHANCEMENT UTILIZING DISTRIBUTED GENERATION IN POSTWAR RECONSTRUCTION

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The wars in Iraq and Afghanistan have presented significant civil-infrastructure rebuilding challenges to these nations, as well as to the United States, coalition allies, and the United Nations. Iraqi and Afghani critical infrastructure has been destroyed or fallen into disrepair due to years of war, international sanctions, sabotage, and neglect. Electrical infrastructure, in particular, is a critical economic and social component that is failing to meet the essential needs of these two countries. This paper is a starting point in researching the viability of integrating distributed generation (DG) resources such as wind turbines, photovoltaic panels, and microturbines into the portfolio of power-generation choices, by quantifying the fully burdened cost of electrical generation in war-torn regions. In this paper, Iraq is used as the sample case for investigating the viability of using DG technologies to enhance the existing electric grid. The fully burdened cost is expressed in the annual lifecycle cost (LCC) of each of the five systems (microturbines, diesel generators, photovoltaic panels, wind turbines, and large-scale, natural-gas turbines) researched, "levelized" to $/kW. LCC includes capital costs, operation and maintenance, fuel costs, energy storage, and security. This research concludes that microturbine systems offer the most cost effective means of making up a 3500MW deficit in Iraq when fuel prices remain at, or below, a baseline price of $2.29/gallon for FY2009. Photovoltaic systems provide the most cost-effective means of making up this deficit when fuel prices increase beyond this baseline price, as they have in Afghanistan.

KEYWORDS: Distributed Generation, DG, DGR, Energy, Electricity, Iraq, Infrastructure, Rebuild, Wind, Solar, PV, Photovoltaic, Microturbine, Generator, LCC, Life-Cycle Cost, Security, War, Reconstruction

SOLVING FOR OPTIMAL-RETIREMENT FINANCIAL PLANS BY MAXIMIZING A DISCOUNTED HABIT-FORMATION UTILITY FUNCTION

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With the increasing popularity of defined-benefit retirement plans, retiring individuals are looking for professional financial advice to help manage their nest eggs. Commonly prescribed generic "one size fits all" rules of thumb such as the 4% rule can carry someone successfully through retirement, but they do not effectively take into account individual expectations or preferences of the retiree or the volatility and risk of the capital markets. An alternative approach is an investment strategy focused on maximizing an individual's utility or "happiness" during retirement. The maximization of a utility function that exhibits habit formation is considered.

The programming language C++ is used to implement a solution algorithm for this maximization problem, and Microsoft Excel is utilized as an interface to present and analyze data. The resulting implementation is a planning tool that provides optimized retirement financial plans according to individual preference.

The effects of habit formation on optimal-retirement consumption and investment plans are demonstrated, and it is shown how a dynamic investment and spending strategy that maximizes an individual's utility can provide a major improvement over the rules of thumb currently practiced. This

thesis solves for optimal-retirement financial plans by maximizing a discounted, habit-formation utility function.

KEYWORDS: Nonlinear Optimization, Retirement, Habit Formation, Maximum Utility, 4% Rule, Asset Allocation

AN ACTIVITY-BASED, NONLINEAR REGRESSION MODEL OF SOPITE SYNDROME AND ITS EFFECTS ON CREW PERFORMANCE IN HIGH-SPEED VESSEL OPERATIONS

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The Navy's future use of shallow-draft, high-speed vessels has provoked questions regarding the effects of resulting ship motion on crews' performance. Sopite syndrome, a commonly overlooked subset of motion sickness, is responsible for lethargy, fatigue, drowsiness, difficulty concentrating, and numerous other performance-diminishing symptoms in shipboard crewmembers who appear to be adapted to vessel motion (Graybiel and Knepton, 1976). Since its discovery in 1976, no physically measurable parameter to quantify Sopite syndrome and its effect on performance has been established. Recent efforts to develop high-speed shallow-draft vessels, coupled with increased automation and reduced manning, place a premium on every crewmember. The manning modifications make it more important than ever to ensure that personnel readiness and performance degradation are accounted for in manning model calculations. This study quantifies Sopite syndrome by using non-linear regression to model activity as a function of time underway and linear regression to model performance. Performance is modeled using the concept of daily activity levels concurrently with ship's motion data, individual demographics and motion sickness questionnaires as input parameters. It is found that over an eight-day underway period, performance on a three-minute manual dexterity task degraded by two to three percent due to Sopite syndrome.

KEYWORDS: Sopite Syndrome, Wrist Actigraphy, Motion Sickness

AN EVALUATION OF MARITIME, OPERATIONAL THREAT-RESPONSE FORCES FOR THE PACIFIC COAST THEATER

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Maritime intercept operations in defense of Pacific Coast ports are resource intensive. A maritime-threat scenario, analytical models, and simulations are used to measure risk to a port given various levels of resource and intelligence. The scenario starts with intelligence that a large, commercial ship arriving to a Pacific Coast port within a 96-hour window poses a security risk. Intelligence further limits the set of threat ships to a subset of all traffic entering a specific port. A limited number of maritime operational threat response (MOTR) forces are available to detect, classify, and intercept the threat ship before it reaches port. In the first scenario, all ships are boarded before entering port, and impact is measured by delay of ships into port. In the other scenarios, intercept ships are routed to suspect ships and risk is measured by the fraction of suspect ships that proceed to port un-boarded because of a lack of MOTR and surveillance assets. The results show that the current Coast Guard force structure is not sufficient to protect Pacific Coast ports against unspecific security threats without additional assets from the MOTR stakeholders or increased intelligence to limit the target set.

KEYWORDS: MOTR, Homeland Defense, MIO, Port Defense, Arena, Analytical Models, West Coast Ports

AN ASSESSMENT OF A HEURISTIC ALGORITHM FOR SCHEDULING THEATER-SECURITY-COOPERATION NAVAL MISSIONS

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Theater-security cooperation (TSC) is a U.S. strategy for improving multinational relationships through cooperative efforts. Spitz developed the Central-West Africa resource and mission allocation (CARMA) optimization model, which posits a naval vessel carrying various expeditionary-partnership teams to transit an area of responsibility and conduct missions garnering the maximum amount of TSC value. CARMA can be solved with formal, mixed-integer optimization at the expense of computational time. This thesis modifies the original Spitz scenarios to test H-CARMA, a fast heuristic algorithm developed by Dwyer, and its performance under shorter planning horizons, multiple budget constraints, and different distribution of missions and TSC value across countries. Most of the scenarios evidence shortcomings of H-CARMA that were not apparent in the earlier scenarios tested by Dwyer. In all but one of the reviewed cases, H-CARMA generates solutions with total TSC value less than 81% of those using Spitz's algorithms, and, in the worst of these cases, the solution only achieves 51%. When there is no slack in terms of time and budget, MIP solutions outperform those of H-CARMA by more than 25% in most cases examined. Sources for some of these deficiencies are identified and changes to address them are recommended.

KEYWORDS: Gulf of Guinea, Logistics Scheduling, Optimization, Mission Routing, Theater Security Cooperation, Algorithm Comparison

OPTIMIZING MULTI-SHIP, MULTI-MISSION, OPERATIONAL PLANNING FOR THE JOINT FORCE MARITIME COMPONENT, COMMANDER

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Operational-level planners in maritime operations centers aim to assign naval forces in support of combatant commanders efficiently and effectively, but they lack a software-based planning tool to develop optimal ship-employment schedules. They must assign ships to particular missions spread throughout numerous regions over a particular time horizon to meet the combatant commander's force requirements. Currently, this is a manual process. The Navy Mission Planner (NMP), a decision aid based on an integer linear program that allows efficient generation of candidate employment schedules, is presented. NMP uses constrained, stack-based enumeration of candidate employment schedules over the feasible region. Total enumeration can produce an enormous number of schedules, easily reaching quadrillions of feasible solutions. By constraining the enumeration to eliminate impractical schedules, the computational burden can be managed and the naval planner can be provided with useful solutions containing a near-optimal set of employment schedules for each assigned ship over the planning horizon. A realistic scenario is submitted and a credible, face-valid solution to the multi-ship, multi-mission assignment problem is provided, with sets of employment schedules that are as good as or better than sets produced manually.

KEYWORDS: Integer Programming, Operational Planning, Navy Mission Planner, Navy Asset-Mission Pairing, Maritime Headquarters, Maritime Operations Center, Constrained Enumeration, Stack-Based Enumeration, Mathematical Programming, Optimization, Decision Aid, Planning Tool, Ship Employment Schedule

GEOTHERMAL HVAC SYSTEMS: A BUSINESS-CASE ANALYSIS FOR NET-ZERO PLUS

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Net-Zero Plus (NZ+) is an approved FY2008 Joint Capability Technology Demonstration (JCTD) initiative led by the United States Army Rapid Equipping Force (REF) and the Office of the Secretary of Defense, Defense Research and Engineering. The purpose of the JCTD initiative is to identify significant military needs and match them to mature technologies or technology demonstration programs, so that military needs can be more rapidly addressed.

The effective implementation of the NZ+ JCTD initiative directly supports the Power Surety Task Force (PSTF), whose mission is to "coordinate Department of the Defense efforts to operationalize efficient devices, conservation practices, intelligent power management, and alternative and renewable power generation, in order to reduce the operational, economic, and environmental vulnerabilities associated with the use and transportation of fossil fuels." To effectively and efficiently achieve its overall goals, NZ+ JCTD looks into three main categories: energy supply, energy demand, and smart energy distribution.

The purpose of this study is to support one of the many Net-Zero Plus project initiatives. Specifically, this thesis assists in determining whether or not it is economically advantageous to install a geothermal HVAC system in a highly insulated, monolithic dome.

KEYWORDS: Loss Net Zero Plus, Power Surety Task Force, Monolithic Dome, Business Case Analysis, Joint Capability Technology Demonstration, Rapid Equipping Force

PROBABILITY OF KILL FOR A VLA ASROC TORPEDO LAUNCH

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The purpose of this thesis is to generate a tactical decision aid (TDA) capable of calculating the probability of kill of a submarine when targeted with a vertical-launched (VLA), antisubmarine, rocket-propelled torpedo (ASROC). In determining the submarine-specific probability of kill (Pk), the passive contact tracker and kill probability (PACT-AKP) TDA will calculate the submarine's position and its area of uncertainty (AOU) based on single or multiple ASW passive sensor bearing-to-target inputs.

In determining the target's position and AOU, PACT-AKP employs an extended Kalman filter that uses MTST movement and measurement models. In calculating ASROC probability of kill, submarine-specific, torpedo-specific effectiveness (TEFF) data collected from the Naval Undersea Warfare Center-Newport is used to generate the Pk algorithm.

It can be concluded that PACT-AKP not only assists the ASW team with target-motion analysis, but also provides the commander with a credible target probability of kill prior to the employment of VLA ASROC torpedoes as a deliberate attack weapon.

KEYWORDS: Area of Uncertainty, Probability of Kill, VLA ASROC, PACT-AKP, Tactical Decision Aid, Extended Kalman Filter, Maneuvering Target Statistical Tracker, Torpedo Effectiveness, Target Motion Analysis

ADAPTIVE SELECTIONS OF SAMPLE SIZE AND SOLVER ITERATIONS IN STOCHASTIC OPTIMIZATION WITH APPLICATION TO NONLINEAR COMMODITY-FLOW PROBLEMS

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An algorithm to approximately solve certain stochastic nonlinear programs through sample-average approximations is presented. The sample sizes in these approximations are selected by approximately solving optimal-control problems defined on a discrete-time dynamic system. The optimal-control problem seeks to minimize the computational effort required to reach a near-optimal objective value of the stochastic nonlinear program. Unknown control-problem parameters, such as rate of convergence, computational effort per solver iteration, and optimal value of the program, are estimated within a receding horizon framework as the algorithm progresses. The algorithm is illustrated with single-commodity and multi-commodity network flow models. Measured against the best alternative heuristic policy considered for selecting sample sizes, the algorithm finds a near-optimal objective value on average up to 17% faster. Further, the optimal-control problem also leads to a 40% reduction in standard deviation of computing times over a set of independent runs of the algorithm on identical problem instances. When the algorithm is modified by selecting a policy heuristically in the first stage only, computing time is improved, on average, by nearly 47% against the best heuristic policy considered, while reducing the standard deviation across the independent runs by 55%.

KEYWORDS: Nonlinear Stochastic Optimization, Optimal Control, Dynamic Programming, Network Commodity Flow, Sample Average Approximation, Projected Gradient Method

MASTER OF SCIENCE
IN
PHYSICAL OCEANOGRAPHY

DIRECT NUMERICAL SIMULATIONS OF DIFFUSIVE STAIRCASES IN THE ARCTIC

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The vertical transport of heat by the diffusive layer in the Arctic thermocline is a critical element of the high-latitude climate, and yet, after decades of research, the extant estimates remain highly controversial. Laboratory-based estimates of vertical heat fluxes originating from the thermohaline staircases of the thermocline are typically on the order of 0.1W/m2. This study suggests that these laboratory experiments underestimate the vertical heat fluxes and exceed their calculations by nearly an order of magnitude.

The typical density ratio, step height, and temperature gradient within the diffusive staircases of the Beaufort Gyre are first quantified. Then, these characteristics are used as an input into a numerical model, which simulates the vertical heat fluxes driven by the double-diffusive processes. The series of two-dimensional simulation runs consistently calculates heat fluxes on the order of 1W/m2. In addition, analysis of a three-dimensional simulation suggests that the three-dimensional fluxes substantially exceed their two-dimensional counterparts. A detailed analysis of the laboratory measurements suggests that the empirical coefficients estimated scaling factors from these experiments are inconsistent with the corresponding numerical simulations. These findings suggest that laboratory-derived flux laws cannot be directly applied to the Arctic Ocean and that further investigations into double-diffusive convective processes are warranted.

KEYWORDS: Double-Diffusion, Diffusive Convection, Heat Flux, Thermohaline Staircase

DIURNAL, SEA-BREEZE-DRIVEN, CROSS-SHORE EXCHANGE ON THE INNER SHELF IN CENTRAL MONTEREY BAY

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Cross-shore exchange on the inner shelf has important impacts on the ecosystem, transporting heat, nutrients, pollutants, and phytoplankton between the midshelf and the surf zone. The effects of a strong (cross-shore wind stress, $\tau sx > 0.05$Pa), diurnal (7-25 hrs), sea breeze on cross-shore exchange at Marina, Monterey Bay, California, is investigated using two years of continuous winds, waves, and ocean velocities. Surface-wind stress has spectral peaks at 1, 2, and 3 cpd, and the diurnal wind variability is greater than 50%. Similar spectral, energetic peaks also occur with waves and currents. During sea-breeze relaxation ($-0.05\text{Pa} < \tau sx < 0.05\text{Pa}$), a background, wave-driven, inner-shelf, undertow profile exists, which is equal and opposite to the Lagrangian Stokes drift, resulting in a net-zero Lagrangian transport at depth. In the presence of a sea breeze ($\tau sx > 0.05$Pa), a uniform offshore profile develops that is different from the background undertow profile, allowing cross-shore Lagrangian transport to develop, while including the Lagrangian Stokes drift. The seasonality of waves and winds modifies the diurnal sea-breeze impact. Therefore, material is hypothesized to incrementally move onshore near the surface and offshore near the sea bed only during sea-breeze events.

KEYWORDS: Sea Breeze, Inner Shelf, Cross-Shelf Transport, Monterey Bay

THE INFLUENCE OF THE ANTARCTIC CIRCUMPOLAR CURRENT ON THE ATLANTIC MERIDIONAL CIRCULATION

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The physics of the meridional overturning circulation and interhemispheric heat transport is explored with an emphasis on the upper and central ocean using a general ocean-circulation model. The ability of the Antarctic circumpolar current, bathymetry, and surface temperature and wind stresses to influence the MOC and interhemispheric heat transport is considered. All experiments are based on an idealized model of intermediate complexity, with analysis focused on the interplay between the surface heat fluxes, geometry, and the meridional transport of heat and volume.

The ACC is found to have an effect comparable in magnitude to that of the mechanical and thermodynamic surface forcing upon meridional circulation and interhemispheric heat transport. Basin geometry also plays a comparatively minor role in the interhemispheric transports, but is essential in creating a realistic ACC by removing some of the momentum imparted by surface wind stresses.

The combination of the ACC and asymmetric surface forcing results in values of interhemispheric transport that are comparable to actual values. This agreement suggests that previous emphasis on deep overturning in the ocean basins and small-scale mixing as a dominant factor in the driving force behind the MOC's strength and maintenance should be reconsidered, with greater emphasis placed on studying the roles of the upper and central ocean.

KEYWORDS: Meridional Overturning Circulation, MOC, Antarctic Circumpolar Current, ACC, Thermohaline Circulation

MASTER OF SCIENCE
IN
SOFTWARE ENGINEERING

A VALIDATION-METRICS FRAMEWORK FOR SAFETY-CRITICAL, SOFTWARE-INTENSIVE SYSTEMS

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Validation of safety-critical software requirements is a difficult and frequently misunderstood task. It answers the question, "are we building the right product?" and is essential to software engineering. However, validation is often confused with verification activities, or simply left as a final tick-in-the-box just prior to delivery. Current models for validation cannot satisfy the unique aspects of safety-critical software where building the right safety product is paramount. Software safety requires a new model for validation of safety requirements by proxy. The need for a proxy model becomes evident in the software safety process, where customer input for safety is reduced to the requirement of "a safe system."

This thesis defines a new, proactive model for validation of safety-critical software requirements. Continuous assessment of the validity of safety requirements is indicated by metrics as part of the validation-metrics framework. The generic framework combines the goal/question/metric approach with goal-structuring notation and then specializes in validation of safety-critical software. The metrics are measurements of safety products typical to safety-critical software-development programs. A fictitious case study of a rapid-action surface-to-air missile is used to apply the framework, identifying the benefits of a proactive, indicative, validation technique utilizing a metrics framework.

KEYWORDS: Software Metrics, Safety Metrics, Validation Metrics, Metrics Framework, Validation, Safety-Critical Software, Software Engineering, Goal Question Metric, Goal Structuring Notation

MASTER OF SCIENCE
IN
SYSTEMS ENGINEERING

A SATELLITE ARCHITECTURE FOR OPERATIONALLY RESPONSIVE SPACE

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Operationally responsive space (ORS) is focused on putting satellites in orbit in significantly less time than it currently takes. ORS is based on responding to an operational need quickly, but it should not be thought of as a new way to place national systems in orbit. Operational needs likely result from a need to augment an existing system or to replace a portion of an existing system. Whether a satellite is required as an augmentation or a replacement, it would need to be placed on-orbit on the order of weeks, not years, as it would take to deploy a satellite from scratch. ORS systems will be a gap filler aimed at maintaining an existing advantage in unforeseen circumstances. This research shows, based on the available literature, how the needs for ORS can be broken down systematically into a set of requirements to be used to design a space system. It provides a basic concept of how an ORS satellite architecture would be developed. Finally, this research also defines a preliminary system design that would enable satellites to be launched on short notice.

KEYWORDS: Operationally Responsive Space, ORS, Satellite

SYSTEMS ARCHITECTURE FOR A TACTICAL NAVAL COMMAND-AND-CONTROL SYSTEM

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Command and control (C2) is an enigma that has been studied by military leaders and warfare analysts for hundreds of years. As a result of the numerous definitions and concepts of C2, the design of C2 systems is a challenge to systems engineers. Adding to the challenge is the understanding and integration of new operational concepts, such as network-centric warfare, identified by stakeholders as necessary to meet operational needs. Through the use of a system-architecture methodology, this thesis creates a general vision of the system; identifies the boundaries of, inputs to, outputs from, and objectives for the system; describes what the system is to do with the identified inputs to produce the desired outputs; describes the resources that comprise the system, the procedures by which the system is used, and the controls on the system; and proposes two alternative system architectures from which an analysis of designs may be conducted. From this methodology, numerous points of integration between doctrine and material, as well as areas for future effort and study, were identified to assist in the development and integration of net-centric systems and net-centric doctrine to meet the command-and-control needs of future tactical naval forces.

KEYWORDS: Command and Control, C2, C3, Systems Engineering, Systems Architecture, Network-Centric Warfare, NCW, Network-Centric Operations, NCO, Doctrine, DOTMLPF

TRANSLATION OF USER NEEDS TO SYSTEM REQUIREMENTS

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Department of the Navy system acquisition begins with a statement of user need. Delivery of required capability depends heavily on the effective translation of user need to system requirements. Failure typically results in program cost overruns, schedule slippage, and sometimes, partial or complete failure to deliver needed capability.

Architectures as part of systems engineering were created to cope with the growing complexity of modern systems. The Navy develops and operates some of the most complex systems in the world. Yet architecture development, while mandated, remains largely ancillary to the systems-engineering process. As a result, much of the engineering advantage of architectures remains untapped.

This study examines U.S. Navy policy, process, and current engineering and architectures standards and identifies recommendations to improve the process of translating user needs to system requirements while facilitating the use of architectures.

KEYWORDS: Architecture, Architecture Framework, DoDAF, JCIDS, Requirements, Systems Engineering

APPLYING RISK MANAGEMENT TO REDUCE THE TIME IN LAY-UP WHILE INCREASING THE COST EFFECTIVENESS OF A USS NIMITZ (CVN 68)-CLASS AIRCRAFT CARRIER IN DRY DOCK DURING THE EXECUTION PHASE OF A REFUELING AND COMPLEX OVERHAUL

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The refueling and complex overhaul (RCOH) of an aircraft carrier is one of the most important milestones in a carrier's lifecycle. An RCOH supports the future modernization efforts that will sustain the carrier and extend its nuclear fuel lifetime an additional twenty-five years. To date, only two USS Nimitz-class carrier overhauls have been completed, with a third in progress. Although these RCOHs were viewed as overall successes, they were unsuccessful from a risk-management perspective because they ultimately resulted in consecutive delivery delay and increased cost. This research assesses three possible risk-mitigation strategies for achieving cost- and time-effectiveness on a *Nimitz*-class, nuclear-powered, aircraft carrier (CVN) in dry-dock during the execution phase of an RCOH. The strategies evaluated are 1) to maintain the current RCOH process, 2) reduce and defer non-nuclear maintenance coupled with schedule compression, and 3) increase the efficiency of power usage of carriers with the intent of eliminating the need for refuelings. The results of this research indicate that eliminating a carrier's RCOH increases its overall cost and time effectiveness. It also reveals that a thirty-three-year carrier lifecycle, as opposed to a fifty-year lifecycle, increases the ship's operational availability and modernization capability.

KEYWORDS: Systems Engineering Process, Risk Management, Risk Analysis, Risk Matrix, Cost Effectiveness, Time Effectiveness, Refueling and Complex Overhaul

MASTER OF SCIENCE
IN
SYSTEMS ENGINEERING MANAGEMENT

THE CARRIER READINESS TEAM: REALIZING THE VISION OF THE NAVAL AVIATION ENTERPRISE

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Naval aviation is a large and complex operation, with multiple stakeholders and an ingrained tension between generating combat readiness for current operations and procurement funds for future capabilities. Naval aviation leadership has developed an enterprise approach to managing these often-competing requirements. This enterprise approach uses modern business-process tools under the fundamental principle of alignment. This process shows remarkable results at the factory level, with production efforts generating significant savings and process efficiencies. From that initial success, the enterprise model is enlarged to overall management of aircraft flight hours, supply parts, personnel, and production of replacement airframes. It is further enlarged to encompass the aircraft-carrier fleet.

This thesis examines the environment that drove the need to employ an enterprise construct, comparing it to the systems-engineering approach used to bring new material solutions from concept of operations to development and sustainment over a product lifecycle. It analyzes the tools and processes used, the benefits gained, and the costs of executing under the enterprise-management scheme. It analyzes how the naval-aviation enterprise model has been exported to other warfighting enterprises and the Navy generally and concludes that enterprise alignment using modern business-process tools indeed provides naval leadership with powerful leverage to generate combat readiness at reduced cost, now and in the future. It also concludes that further work remains to be done to ensure that an ingrained culture of consumption becomes cost aware and that real alignment of missions, functions, and tasks must be undertaken to ensure that "quick wins" eventually translate into sustained, strategic change management.

KEYWORDS: Systems Engineering, Business Process Engineering, Naval Aviation Enterprise, Carrier Readiness Team, Enterprise, Alignment

MASTER OF ARTS

Security Studies

MASTER OF ARTS
IN
SECURITY STUDIES

THE EUROPEAN UNION'S HUMAN-SECURITY DOCTRINE: A CRITICAL ANALYSIS
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The term "human security" first officially appeared in reference to international relations in 1994, within a report by the UN Human Development Program. The concept has fast been gaining supporters and sparking associated intellectual debate. It challenges the traditional concept of security by contending that the central focus of security efforts should be the individual human being, not the nation-state, as has been —and remains—the typical focus of analysis. This thesis investigates the hypothesis that the doctrine of "human security," which has been featured in official policy statements of the European Union (EU), is not yet well formulated. Partly because it is inconsistently defined, it has been difficult to implement. Four criticisms stand out: namely, that the human security concept is vague, incoherent, arbitrary, and difficult to operationalize. The EU has nonetheless attempted to make human security an element of its European security and defense policy (ESDP), with mixed results—reservations as to its limitations and acknowledgements of its achievements.

KEYWORDS: Human Security, European Union, European Security and Defense Policy

THE USE OF STATE AND LOCAL LAW ENFORCEMENT FOR IMMIGRATION ENFORCEMENT UNDER FEDERAL AUTHORITY 287(G): A CASE-STUDY ANALYSIS
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The issue of 12–20 million foreign nationals illegally present within the United States brings with it a number of homeland-security questions and concerns. The threat of terror organizations utilizing porous borders or lack of enforcement against the U.S. is highly probable. However, in order to deal with the issue of illegal immigration and the homeland-security threat that is attached to this problem, the country must develop a strategy that is efficient and effective for all.

One possible strategy for combating illegal immigration is the utilization of section 287(g) of the Immigration and Nationality Act, which grants, under limited conditions, law enforcement agencies the authority to use immigration-related information to advance local policing efforts. However, the issue of state and local enforcement of immigration-related matters has become highly contentious. Much has been written about it, but little data has been collected on what these enforcement programs actually do, rather than what supporters and opponents hope or fear they will do.

The purpose of this thesis is to examine several situations in which state and local agencies have implemented the 287(g) program. While it is true the use of this authority as a strategy has many factors and elements that must be reviewed prior to further implementation, it is in reality a necessary partnership

and a prudent measure to keep the nation and its communities safe. The 287(g) program should be strongly considered a national strategy for combating illegal immigration.

KEYWORDS: Illegal Immigration, Immigration, 287(g) Program, Immigration and Nationality Act, Interior Enforcement, Homeland Security, Immigration and Customs Enforcement

HEZBOLLAH: PSYCHOLOGICAL WARFARE AGAINST ISRAEL

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Since the 34-day war in 2006 between Hezbollah and Israel, psychological warfare has reemerged as a topic of interest. Many experts have asked the question, how could a non-state actor defeat Israel—a regional superpower—in such a short time? Hezbollah also defeated Israel in 2000 when it forced the state to unilaterally withdraw from southern Lebanon after an 18-year occupation. Although Hezbollah's psychological warfare strategy contributed greatly to these two successes, there also are other factors that contributed to Israel's failures. First, Israel incorrectly assessed its enemy, resulting in the development of overly ambitious objectives for Lebanon and the application of inappropriate strategies. Israel underestimated the support Hezbollah enjoyed from the Lebanese population through years of political participation and providing security, economic, and social services. Second, Israel's aversion to casualties inhibited it from choosing bolder military strategies. Third, Hezbollah waged effective guerrilla warfare against Israel's conventional military efforts. By embedding itself within the civilian population, the group became a difficult target to attack through conventional warfare. Hezbollah's psychological warfare strategy played a crucial role in exploiting Israel's military mistakes and its aversion to casualties.

KEYWORDS: Hezbollah, Israel, Psychological Warfare, Information Operations, Strategic Communications, Guerrilla Warfare, Fourth Generation Warfare, Terrorism, Islamic

CRICKET'S CONTRIBUTION TO INDIA'S NATIONAL SOLIDIFICATION

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India's extremely diverse society has managed to hold together for over sixty years. There are a number of possible explanations for this, but one explanation that is often underappreciated is popular culture, especially sport. Specifically, cricket has had a number of effects that appear to have contributed to social cohesion. This study asks what effects has cricket had on the solidification of the Indian nation–state.

This thesis focuses on three of cricket's contributions in particular. First, it finds that cricket served as a catalyst, reflection, and expression of India's struggle for independence. Second, cricket provided a central social activity that created shared experiences and memories, and in doing so helped represent and meld many ethno-religious subcultures into one broader Indian polity. Finally, cricket served as a tool for international diplomacy and as one of India's greatest expressions of national prestige.

This study looks at Indian solidification by shining the narrow light of cricket through the prism of Indian nationalism, thereby providing a small, but important, piece of the complex puzzle of what brought India together.

KEYWORDS: Indian Nationalism, Nation-State, Cricket, Sports, Society

MEASURING PREPAREDNESS: ACCESSING THE IMPACT OF THE HOMELAND-SECURITY GRANT PROGRAM

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Since the creation of the U.S. Department of Homeland Security (DHS) in 2003, DHS has awarded over $28.7 billion dollars in grant funds to states, locals, territories, and tribal entities to enhance prevention, protection, response, and recovery efforts. Yet the homeland-security community continues to struggle with measuring the impact these investments have made toward improving preparedness. The 2009 *Federal Preparedness Report* highlights that the nation lacks risk-based performance metrics, accurate data, and analytical tools to measure how these investments have improved preparedness. This thesis outlines the challenges of measuring preparedness across the numerous federal funding streams, assesses the prevalence of these factors, and proposes five recommendations for improving the capacity to answer the questions of how prepared we are, how prepared we need to be, and how we close the gap between the two.

KEYWORDS: Homeland Security Grant Program, Grant Management, Emergency Preparedness, National Preparedness

THE POSSIBLE CORRELATIONS OF MULTINATIONAL MILITARY OPERATIONS AND STATE STABILITY, AND APPLICATION TO STATE-BUILDING IN IRAQ

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This thesis explores the possible correlation between participation by emerging states in multinational military coalitions and increased stability of those emerging states. The level of multinational military participation is regressed against three metrics of stability: level of democracy, occurrence of internal conflict, and occurrence of external conflict. Implications of correlations discovered are discussed with respect to policy relevance toward state building and reconstruction in Iraq.

KEYWORDS: Multinational Operations, United Nations Peacekeeping Operations, Emerging State Stability, Reconstruction in Iraq

DO GOOD FENCES STILL MAKE GOOD NEIGHBORS? INTEGRATING FORCE PROTECTION WITH HOMELAND SECURITY ON ARMY INSTALLATIONS

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Army installations have been uniquely affected by the global war on terrorism (GWOT) and homeland-security initiatives as a result of the attacks on September 11, 2001. Unfortunately, most have not done enough in coordinating and integrating their antiterrorism plans with the crisis response and consequence management plans of their adjacent civilian municipalities. This thesis argues that fences and guards are not enough to protect Army installations against a terrorist attack, or against any other natural or man-made disaster, nor do installations have the wherewithal to respond effectively on their own should disaster strike. Doctrine is clear, and regulations and policy have been published guiding the Army (and other military services) in providing civil support to state and local authorities during times of crisis; but what is

less clear, or more precisely, nonexistent, is doctrine regarding how Army installations would receive and integrate support from local and state officials in response to disasters occurring on the installation. Now more than ever, Army installations require municipal support to effectively respond to terrorist attacks, natural disasters, and accidents. Indeed, Army installations must reach across their perimeter fences and embrace municipal partners in integrating force protection with homeland security.

KEYWORDS: Homeland Security, Homeland Defense, Force Protection, Antiterrorism, Civil Support, Emergency Management, Installation Management, Army Installations

INCREASING CAPACITY AND CHANGING THE CULTURE: VOLUNTEER MANAGEMENT IN LAW ENFORCEMENT

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In the post-September 11th world, law-enforcement agencies are struggling to protect their communities from the threat of global terrorism, along with preparing for and responding to natural and man-made disasters. The demands on municipal law-enforcement agencies have never been greater. Today, more than ever, it is clear that volunteers can play a fundamental role in augmenting a department's homeland security efforts. Are there best practices when incorporating volunteers into a law-enforcement agency and how does law enforcement maximize its volunteer effort? This thesis answers the question: how does a designated volunteer coordinator impact mission performance in a law-enforcement agency's volunteer program? Furthermore, the research addresses the role of volunteers in law enforcement, including how volunteers can augment an agency's homeland-security strategic plan.

Research includes a survey, a literature review, and a case study. Although the research and survey data do not provide incontrovertible proof that a volunteer coordinator is a necessity to a volunteer program, there is sufficient evidence to show that a volunteer program is more effective when properly managed and led.

KEYWORDS: Volunteer, Volunteer Coordinator, Pasadena Police Department, Volunteer Services, Sierra Madre Police Department

CHINA'S SPACE PROGRAM: A NEW TOOL FOR PEOPLE'S REPUBLIC OF CHINA "SOFT POWER" IN INTERNATIONAL RELATIONS?

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When China launched an antisatellite (ASAT) weapon in January 2007 to destroy one of its aging weather satellites, most of the reaction from academics and U.S. space experts focused on a potential military "space race" between the United States and China. Overlooked, however, was China's growing role as a global competitor on the nonmilitary side of space. China's space program goes far beyond military counterspace applications and manifests manned space aspirations, including lunar exploration. Its pursuit of both commercial and scientific international space ventures constitutes a small, yet growing, percentage of the global space launch and related space-satellite service industry. It also highlights China's willingness to cooperate with nations far away from Asia for political and strategic purposes. These partnerships may constitute a challenge to the United States and enhance China's "soft power" among key American allies, even in some regions traditionally dominated by U.S. influence (e.g., Latin America and Africa). Thus, an

appropriate U.S. response may not lie in a "hard power" counterspace effort, but instead in a revival of U.S. space outreach of the past, as well as implementation of more business-friendly export-control policies.

KEYWORDS: China, People's Republic of China, Space, Satellites, Soft Power, Counterspace, APSCO, APRSAF, U.S. Space Policy, Space Security, ASAT, ITAR

THE COMPONENTS NECESSARY FOR SUCCESSFUL INFORMATION SHARING

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The need for information sharing is a growing concern for many agencies in homeland security. As communities struggle to prepare for and respond to major incidents, information sharing between agencies is vital. Fusion centers have developed around the law-enforcement community, which has led to an information-sharing network that is exclusive. Non- law-enforcement agencies charged with preparing for and responding to major incidents, such as fire, EMS, and public health, need the exchange of information as well. This thesis identifies several components that affect knowledge transfer. The human elements of relationships, trust, mega-communities, governance, and leadership form the basis for successful information-sharing networks. On this basis, the technical components of the information-sharing network, such as standard operating procedures, technology standards, and interoperability, can be built.

KEYWORDS: Fusion Centers, Information Sharing, Governance, Agreements, Relationships, Trust, MOAs, SOGs, SOPs, Technology, Interoperability, Mega-communities, Standards

SHIA RITUALS: THE IMPACT OF SHIA RITUALS ON SHIA SOCIO-POLITICAL CHARACTER

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This thesis argues that Ashura rituals do not represent the embodiment of a culture of death; they represent a spiritual awakening, strengthening faith by condensing and intensifying religious events, unifying and empowering the Shia identity. Secondly, it argues that Ashura rituals are not merely rituals of lamentation or a source of salvation and redemption; they represent an inspiring force with dynamic principles used as a popular platform to effect changes in the sociopolitical sphere.

This research probes into the historical evolution in form and content of Ashura rituals. It reveals three major stages Ashura rituals that have passed through.

This research uses a model derived from Emile Durkheim's social-ritual theory to explain how rituals transform knowledge into belief and membership into belonging. It reveals how Ashura rituals are constructed, embraced, and evolved, as well as how they are shaping Shia identity and communal sense. The discussion also centers around important Shia leaders who were instrumental in shifting the meanings of Ashura from soteriological to revolutionary meanings, as well as leaders who have operationalized such meanings. It compares current ritual practice in Iran and Lebanon. The research concludes by discussing the political implications of such a shift.

KEYWORDS: Shia, Ashura Rituals, Battle of Karbala, Shia Schism, Majalis al-Ta'ziya, Ziyarat Ashura, Ziyarat Arba'In, al-Mawakib al-Husayniyya, Tashabih, Zangeel, Latm, Qira'ah, Qari or Khateeb, Niyahah, Shia Procession, Self-Flagellation, Emile Durkheim, Khomeini, Sistani, Motahhari

JUDICIAL REVIEW: STATE SUPREME-COURT JUDICIAL VIEWS ON BALANCING CIVIL LIBERTIES AND PUBLIC SAFETY/SECURITY MEASURES DURING THE GLOBAL WAR ON TERRORISM

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Political responses to terrorism in the United States and the international community have included placing limitations upon and suspending civil liberties. Since constraining civil liberties may lead to the spread of terrorism, balancing the competing interests of individual civil liberties and public safety/security measures imposed by government in times of national emergency is essential to reducing terrorism and to the pursuit of peace. Through the mechanism of judicial review, constitutional courts (both federal and state) serve to guard civil liberties against government encroachment. Yet some scholars decry judicial review as counter-majoritarian, an illegitimate and undemocratic exercise in a representative democracy; while others laud judicial review as an essential function to advance peace, public participation in governing, and legitimating democracy's quest to reduce terrorism.

This thesis seeks to transcend the debate over judicial review by exploring the views of state supreme-court justices on what factors they consider essential to consider when balancing competing interests. It invites the reader to engage a global discourse. To participate in the political spaces, judges accept that because judicial review offers an alternative to the sword, it is material and relevant to reducing terrorism and that by focusing on the signals the justices send, the public might respond adequately to preserve human dignity during the global war on terrorism and beyond.

KEYWORDS: Judicial Review, Balancing Civil Liberties, Global War on Terror, Political Spaces, Strategic

THE PANDEMIC PENDULUM: A CRITICAL ANALYSIS OF FEDERAL AND STATE PREPARDENESS FOR A PANDEMIC EVENT

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This paper explores pandemic-planning efforts across federal and state jurisdictions and how the absence of collaboration could have major consequences upon the population of the United States. How adequate are state and federal pandemic plans, and what must be done nationally to address common shortfalls? The methodology uses a hybrid approach by combining a secondary analysis of available data with a modified case-study approach. Analyzing the individual state plans and HHS' pandemic-influenza plan reveals common deficiencies and discloses distinct functional areas where stringent collaboration across multiple jurisdictions and functional areas would mitigate the deficiencies and provide a blueprint for potential development into an all-hazards national-catastrophe plan. This comprehensive plan would provide a solid template for all stakeholders to use in further development of their individual plans, and additionally provide a mechanism to propagate proactive planning efforts among international disaster-preparedness partners.

KEYWORDS: Pandemic, Pandemic Planning, Influenza Pandemic, Planning, State Pandemic Plans

THE MUSLIM BROTHERHOOD IN EGYPT, JORDAN, AND SYRIA: A COMPARISON

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The Islamic group the Muslim Brotherhood (MB) exists in many countries around the world, but each group is fundamentally different than its parent organization. Why is this so? Likeminded organizations that are built upon common guiding principles superficially have little reason to change. The goal of this thesis is to understand why MB groups in three different countries did in fact change and become something highly differentiated from their progenitor group. After a thorough examination of the MB in Egypt, Syria, and Jordan, it is discovered that the type of government in place and demographic factors were highly instrumental in the formation and subsequent development of these groups. The level of restriction imposed by a government on its population helped determine the militancy level of the MB within a country's borders. The demographic makeup of the country also has a profound and deterministic effect on the acceptable *modus operandi* that the groups could employ to achieve their political goals.

KEYWORDS: Muslim Brotherhood, MB, Islamist, Gradualist-Pragmatic, Demographics, Tawid, Jihad, Jam'iyah, Nasser, Siba'i, Islamic Action Front, IAF

KOREAN UNIFICATION: THE WAY FORWARD

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This thesis examines three potential scenarios for the unification of the Korean peninsula: 1) the collapse of the Democratic People's Republic of Korea (DPRK) government, followed by its absorption into the Republic of Korea's (ROK) current governmental structure; 2) a possible free-trade area (FTA) encompassing the Korean peninsula, with the potential to expand to neighboring nations; and 3) the establishment of special economic zones (SEZ) within the DPRK, using business practices from both ROK and the PRC models to strengthen their economic and national ties.

A matrix of five variables is used to measure the effectiveness of each scenario, including time, cost, stability, international acceptance, and building trust between the two Korean states. The scenarios are examined through the lens of the theory of economic interdependence to understand the importance of economic engagement throughout the Korean Peninsula, including the economic path of each state. The hypothesized end-state would encompass a single Korean nation that actively participates in the international community while remaining free of nuclear weapons. A section of this research is dedicated to understanding how this new nation might emerge on the international scene, as well as how the neighboring countries view the possibility of a unified Korean nation.

KEYWORDS: Korean Unification, Republic of Korea, Democratic People's Republic of Korea, Economic Interdependence, Special Economic Zones, Free Trade Area, Collapse

THE MONTREUX CONVENTION REGARDING THE TURKISH STRAITS AND ITS IMPORTANCE AFTER THE SOUTH OSSETIA WAR

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The Turkish Straits include the Dardanelles (Çanakkale) and Bosporus (Istanbul) straits and the Marmora (Marmara) Sea between them. The Turkish Straits are the only waterways connecting the Black Sea to the Aegean and Mediterranean seas and to the oceans through the Suez Canal and the Straits of Gibraltar. Regulation of passage through the Turkish Straits has caused many problems throughout history.

Since 1936, passage through the Turkish Straits has been governed by the Montreux Convention. Following the South Ossetia War in August 2008, the Turkish Straits again became problematic when Turkey denied passage to U.S. warships seeking to transit the straits.

This thesis analyzes three key research questions surrounding use of the straits: Can the Montreux Convention satisfy current requirements? Should the Montreux Convention be revised? If modifications in the Montreux Convention are necessary, what modifications are appropriate and how might they affect stability in the Black Sea?

KEYWORDS: Turkish Straits, Istanbul Strait, Canakkale Strait, Montreux Convention, Passage Regime in the Turkish Straits

EMPOWERING CHILDREN TO LEAD CHANGE: INCORPORATING PREPAREDNESS CURRICULA IN THE K-12 EDUCATIONAL SYSTEM

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A combination of both man-made and natural disasters in recent years has revitalized the concept of civil preparedness and defense in the United States. During his state of the union address in 2002, President George W. Bush announced the creation of the Department of Homeland Security (DHS) Citizen Corps, a component of the USA Freedom Corps initiative developed shortly after 9/11. Additionally, FEMA launched the "Are You Ready?" campaign to provide individuals, families, and communities with in-depth preparedness information and training, and the American Red Cross developed its own educational disaster-preparedness program designed to coincide with the daily threat level. While the various programs include several common themes, including special emphasis on disaster preparedness for children, they lack promotion, visibility, standardization, and coordination. Empowering children to lead change by teaching families and other citizens is one possible methodology to enhance visibility and inspire participation in such programs. This thesis explores the pros and cons of historical and current citizen-preparedness campaigns and K–12 preparedness curriculums, other countries' approaches to citizen preparedness, elements of successful preparedness programs, homeland-security stakeholder benefits, and arguments against implementation. Criteria for successful K–12 curricula are provided.

KEYWORDS: Preparedness, Civil Defense, Children, K–12 Curricula, Citizen Preparedness, Homeland Security

INCREASING NAVAL-SECURITY COOPERATION BETWEEN THE U.S., CHILE, AND PERU

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Naval security cooperation can take many forms, from joint exercises to bilateral and multilateral agreements. In response to the challenges of providing stability and security for the world's oceans, the "thousand-ship-navy" was born. In the thousand-ship-navy, partner-nation navies would voluntarily participate in common maritime goals in a "come as you are" manner. One possible vehicle for implementing the concept is maritime-domain awareness, which seeks to create a common operating picture from naval, federal, state, private, and international partners. These partners would be able to feed any information they gather into the system and be able to access the combined information from all sources in the common operating picture. This thesis examines the probability of using maritime domain awareness to pursue a thousand-ship-navy style of naval-security cooperation in the eastern Pacific among the navies of the United States, Chile, and Peru.

KEYWORDS: Naval Security Cooperation, Thousand Ship Navy, Maritime Domain Awareness, Chile, Peru

THE FUTURE OF JAPAN'S SECURITY POLICY: IS NORMALIZATION A POSSIBILITY?

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This thesis considers the future direction of Japanese security policy by examining the debate on whether or not Japan will "normalize." Normalization is defined as the process of Japan removing its restrictions on the use of military force. Arguments exist that Japan is on the path to removing these restrictions because of a variety of factors, such as Japan's worsening security environment and its recent decision to introduce a ballistic missile defense (BMD) program. In contrast to these views, this thesis suggests that Japan will not normalize due to the presence of strong anti-military feelings that exist within the society, at both the public and political levels. To test this hypothesis, public opinion, politician opinions, and political party opinions are researched on four issues: general constitutional revision, a specific revision of Article 9, possible changes in the right to exercise collective self-defense, and opinions on Japan's new ballistic missile defense program. It is concluded that strong anti-military feelings continue to persist at both levels of Japanese society and that these feelings are an effective obstacle to Japan's normalization. Based on this conclusion, it is recommended that the United States increase its efforts to secure Japan's participation in non-combat-related activities.

KEYWORDS: Japan, Normalization, Constitution, Revision, Article 9, Collective Self-Defense, Ballistic Missile Defense

DEFENDING THE AMAZON: CONSERVATION, DEVELOPMENT, AND SECURITY IN BRAZIL

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The struggle between development and conservation remains salient with today's focus on global climate change. This conflict is seen most clearly in the Brazilian Amazon. Internationally, developed nations advocate conservation, while developing nations fight for progress. Conservationists expect international organizations, developed nations, and domestic grassroots organizations to pressure the Brazilian government in conserving the Amazon. Development advocates point to the need to stabilize Brazil's economy and expand into the Amazon for its untapped resources. To understand the impasse between these two forces, one must look to a third actor: the Brazilian military. This thesis examines the critical role of the military in Amazonian policy. Guaranteeing Brazil's borders and national security, the military views its infiltration of the Amazon as part of its mission. It also sees development and population increase as tools the government must use to increase sovereignty over the Amazon. This thesis concludes that the military and its concerns must be addressed before development policy in the Amazon can be changed. The Amazon must be conserved as a global resource, but will continue to be developed until the military's role and views are taken into account.

KEYWORDS: Brazil, Amazon, Security, Conservation, Development, Climate Change, Military, Sovereignty, Calha Norte, SIVAM, Sustainable Development, Civil-Military Relations, Extractive Reserves, Indigenous Reserves, Worker's Party, FHC, Lula

THE FUTURE OF THE U.S.–REPUBLIC OF KOREAN ALLIANCE AND THE RISE OF CHINA

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It is inevitable that the PRC will continue to extend its influence over South Korea (ROK). Korea recognizes that China, as a land-based identity, has historically tried to form its sphere of influence and intervened in Korean affairs. Despite anti-Americanism in Korea, Seoul understands that there is a strong need for the U.S.–Republic of Korean alliance not only to deter the DPRK, but also to ensure that maritime power can counterbalance Chinese intrusion in Korean affairs. History shows that Korea has preferred to rely on an external power to counterbalance against a proximate power, and it would be a tough situation for the ROK to withstand the weight of the PRC alone. Seoul's security interest will dominate the cultural and economic aspects of relations with China. Therefore, Seoul has a vested interest in ensuring the preeminence of the United States. Seoul must send an unambiguous signal to Washington that it continues to desire the U.S.–ROK alliance, while maintaining its economic relationship with Beijing. Beijing must recognize that the presence of American forces is a historical and geopolitical necessity for South Korea.

KEYWORDS: South Korea, Qing-Chosun Tributary System, U.S.-ROK Alliance, Anti-Americanism

A HIERARCHY OF NEEDS IN INTERNATIONAL RELATIONS

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Characterizing U.S.–Russian relations as a new Cold War is nostalgic for many, but it does not accurately describe Russian motivation behind its current behavior. Abraham Maslow, a prominent behavioral psychologist, investigated motivation behind human behavior and concluded that human motivation centers on satisfying five basic needs. It is plausible to modify his hierarchy of basic human needs and develop a similar hierarchy of basic state needs. A single case study examining Soviet regression from a strong state identity and the Russian Federation's attempts to reestablish it demonstrates the utility of this hierarchy. Understanding where a state falls in its pursuit of a strong state identity gives intelligence analysts providing assessments to U.S. policymakers a framework to assess, categorize, and predict general trends in state behavior. Consequently, it becomes more accurate to describe current Russian behavior as an attempt to satisfy its prepotent need for external security, while also attempting to satisfy (to a lesser extent) its need for prestige and domestic security. This comprehensive explanation of motivation behind Russian behavior allows U.S. policymakers to craft policy that either helps or impedes Russia in its pursuit of a strong state identity.

KEYWORDS: Russia, Soviet Union, Intelligence, Foreign Policy, Maslow, Hierarchy of Needs, NATO, CSTO, SCO, Central Asia, U.S.-Russia Relations, NATO-Russia Relations, International Relations, Political Science, Foreign Policy, Legitimacy, Domestic Security, External Security, Prestige, Strong States, State Identity, Needs, State Behavior

TERRORISM PREVENTION AND FIREFIGHTERS: WHERE ARE THE INFORMATION-SHARING BOUNDARIES?

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The nation's million firefighters are embedded in virtually every urban or rural area of the United States. Firefighters enter homes, businesses, vehicles, and other assets during emergency and nonemergency duties thousands of times each day in their efforts to prevent or respond to life and property loss. The unparalleled access that firefighters have to public and private locations puts them in a unique position to positively or negatively impact the nation's homeland-defense-and security information-sharing efforts. This thesis analyzes a number of information-sharing activities relating to terrorism and all-hazard strategies, policies, and programs in an attempt to identify whether U.S. fire personnel should participate in terrorism-related information sharing and—if they should participate—where the legal, political, and operational boundaries lie. The research identifies a number of new, strategic applications and tactical practices. The strategies and tactics are the result of comparing and contrasting legal compliance, political acceptability, target capabilities list linkage, operational impact, and cost factors of the current U.S. fire service information-sharing environment, the New York City fire department's terrorism- and disaster-preparedness strategy, the U.S. Fire Service's intelligence enterprise, and the United Kingdom's Civil Contingencies Act.

KEYWORDS: Firefighters, Terrorism, Prevention, Protection, Response, Information Sharing, U.S. Fire Service, Homeland Security, New York City Fire Department Terrorism and Disaster Preparedness Strategy, U.S. Fire Service Intelligence Enterprise, Civil Contingencies Act, Legal, Operational Impact, Cost, Political, Target Capabilities List

MARITIME TERRORISM AND THE SMALL-BOAT-ATTACK THREAT TO THE UNITED STATES: A PROPOSED RESPONSE

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This thesis examines the history and current trends of international maritime terrorism to show that terrorists may soon determine that small-boat attacks may be the most cost-effective and successful terrorism strategy. This review determines that increasingly successful worldwide piracy attacks and the effective use of detection-evading drug vessels may increase the risk of a terrorist attack in American waters. These reviews and lessons learned from other nations' successful responses to the maritime threat, in coordination with the goals outlined in the DHS small-vessel security strategy, led to the author's recommendations that 1) local U.S. maritime community members be better encouraged by Coast Guard members to become involved in observing and reporting suspicious activities; 2) the Coast Guard and other local law-enforcement agencies investigate and prioritize those areas that might be used for staging a small-boat attack and increase their presence in those locations; 3) the use of up-to-date technology be a part of any small-boat terrorist-deterrence plan; and 4) the U.S. be prepared to respond to a successful small-boat attack, including possible increased regulations and restrictions on the maritime community.

KEYWORDS: Coast Guard, Maritime Terrorist, Piracy, Semi-Submersibles, Security, Small Boats, Americas Waterways Watch, Maritime Domain Awareness, Department of Homeland Security

TURKEY'S RELATIONS WITH IRAN AND THE UNITED STATES: A SHIFT IN ALIGNMENT?

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This thesis examines the past and present condition of Turkey's relations with an ally, the United States, and an old neighbor, Iran, and identifies the variables that have divided or united these three important players of the Middle East since 1979.

The goal of this thesis is to answer the following questions: is Turkish foreign policy changing direction? Is there really a common ground for Turkey and Iran to cooperate for the stability of the region? Is cooperation possible for these two old rival states, each of whom has been seeking to be the dominant power of this region since the very beginning of their relations' long history? If yes, is it worthwhile for Turkey to improve her relations with Iran even in the face of U.S. opposition? In this context, although there seems to be a relative recovery in Turkish–Iranian relations and a decline in Turkey's relations with the United States due to diverging interests in the Middle East, Turkey and the United States should realize their importance to each other. They should establish a stronger structure to synchronize relations so they do not end up in a "lose-lose" position by ignoring each other's priorities.

KEYWORDS: Turkish-U.S. Relations, Turkish-Iranian Relations, Turkey's Foreign Policy, PKK Terrorism, Stability in the Middle East

RUSSIAN VODKA: A NATIONAL TRAGEDY

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Russian governments promoted vodka because it was a major source of income. As a result, Russians are culturally conditioned to consume alcohol and are facing tragic demographic declines never before seen in the developed world. Russia's autocratic governments are responsible for the development of vodka addiction. The crown used vodka as a source of income and steered the agrarian economy in the direction of vodka production. The Russian church used vodka as a means to control the peasants and as a form of payment, further cementing the peasants' dependency on alcohol. Russian culture, steeped in religious mysticism and social compliance, promulgated vodka consumption. The importance of vodka did not diminish after the communists took over—the entire Soviet social fabric strongly depended on vodka. This generational consumption has resulted in unprecedented demographic declines that affect the Russian economy, healthcare, and military. Centuries of dedicated vodka consumption have brought Russia to the brink of societal collapse. Only social education, open markets, and inclusion into the free world communities can reverse Russia's downward spiral. The U.S. needs to play a leading role in Russia's recovery in order to ensure the end result of a nuclear-armed friend instead of an ostracized and insecure enemy.

KEYWORDS: Russia, Vodka, Demographics, Alcoholism

PROSELYTIZATION IN ALBANIA BY MIDDLE-EASTERN ISLAMIC ORGANIZATIONS

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Since the fall of communism in 1992, Albania has undergone fundamental reform and change. Some of the more profound changes have included massive migration, open elections, the 1997's governmental meltdown, and religious revival. Although most of the changes have been welcomed and positive, some have created problematic situations. Although the revival of Islam was seen as a sign of freedom, it soon became an unexpected problem for the government and the population.

Through nonprofit organizations, schools, aid, and porous borders, Islamic extremists were able to access a small part of the population. However, Albania's long history of religious tolerance, shallow roots in formal religion, and Western cultural orientation has created a hostile environment for radical Islam.

KEYWORDS: Loss Revival of Islam in Albania, Islamic Extremists, Religious Tolerance, Democratic Reforms

THE IMPLICATIONS OF CHINA'S GROWING MILITARY: DIPLOMATIC CLOUT FOR THE UNITED STATES—COOPERATION, COMPETITION, OR CONFLICT?

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China's military capabilities are growing and so is Beijing's ability to employ its military in diplomatic capacities. Since the Chinese military's power-projection capabilities remain limited, the preponderance of its activities still fall within Asia. This thesis uses a three-step process (comparing, analyzing, and extracting implications) to assess whether increased levels of Chinese military diplomacy will shift the Sino–American military relationship towards competition, cooperation, or conflict. This research effort finds that differences in U.S. and Chinese capabilities and political interests lead to disparities in the military–diplomacy activity level, selection of strategic partners, and preferred diplomatic tools. However, despite these differences, the potential for increased Sino–American military cooperation remains high. In order to capitalize on such potential, policymakers should endorse a contingency-based cooperative approach to building military-to-military relations between the United States and China. This approach encourages China to become more of a responsible stakeholder and exert positive influence in Asia through its military interactions.

KEYWORDS: People's Republic of China, United States, Military Relations, Military Diplomacy

STRENGTHENING HOSPITAL SURGE CAPACITY IN THE EVENT OF EXPLOSIVE OR CHEMICAL TERRORIST ATTACKS

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Medical care is a public trust. Americans expect that hospitals and healthcare providers will be available and prepared to care for their every medical need. Yet, with current resources, the medical community is severely challenged on a daily basis in caring for the influx of patients to its emergency departments. Healthcare is ill prepared to meet community needs in the event of a mass-casualty event from a terrorist attack using weapons of mass destruction.

This research explores the premise that clinicians have skills, either current or remote, that can be renewed and enhanced to provide an immediate, lifesaving response team in the event of explosive or chemical events. The research identifies that the medical community has the building blocks available, but is awaiting the guidance, organization, and direction needed to orient them into a disaster medical capability that will improve preparedness and response. This thesis proposes a strategy to leverage the clinician personnel assets already in place to improve preparedness.

A transformational approach is necessary to ensure healthcare preparedness. Government planners must understand the challenges and current limitations of emergency medical response and partner with healthcare providers to enhance preparedness. The American medical community must understand the realities of terrorism and war at home.

KEYWORDS: Hospital Preparedness, Emergency Medicine Preparedness, Medical Surge, Surge Capability, Chemical Agent Preparedness, Explosive Agent Preparedness, Physician Preparedness

SUGGESTIONS FOR IMPROVING THE RECRUITMENT OF AL-QAEDA SOURCES: LESSONS DERIVED FROM COUNTER-IDEOLOGICAL PROGRAMS AND THE TARGETING OF TYPE-B TERRORISTS

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How can the Federal Bureau of Investigation improve the recruitment of human-intelligence sources within terrorist groups, specifically al Qaeda? First, counter-ideological programs combating terrorist ideology have application in source recruitment. Second, a cognitive framework for recruiting terrorist sources is found in the work of Paul Davis and Brian Jenkins of the RAND Corporation. They suggest that terrorists can be usefully categorized as internalists or externalists, or types A or B. Type-A terrorists have insatiable appetites and display emotional aggression. Type-B terrorists have instrumental aggression and "pragmatic world goals." Significantly, research suggests that terrorists displaying instrumental aggression, the type Bs, should be more "sensitive" to "objective rewards and punishments."

Two case studies demonstrate how to determine if a potential terrorist source is type A or B. This is accomplished by examining the terrorist's background for instrumental or emotional aggression, assessing levels of risk and ideological commitment, part-time or fulltime commitment to jihad, and high or low social-intensity syndrome. The more recruitable type Bs, when compared to their type-A counterparts, display instrumental aggression, have lower levels of risk and ideological commitment, have part-time commitment to jihad, and display low levels of social-intensity syndrome. The conclusion of this thesis is that the FBI should concentrate recruitments on the more pragmatic type-B terrorists. Type-B terrorists are found in the peripheral functions of terrorist organizations, are consequently more accessible than their type-A counterparts and more likely to cooperate with the FBI in providing intelligence.

KEYWORDS: Al-Qaeda, FBI, Human Intelligence Sources, Recruitment of Sources, Risk and Commitment, Part-Time and Full-Time Jihadists, Instrumental and Emotional Aggression, Social Intensity Syndrome, Terrorism, Counter-Terrorism, Counter-Ideological

STATE CAPACITY AND RESISTANCE IN AFGHANISTAN

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This thesis seeks to explain why current attempts to expand the reach of the Afghan government in Kabul are met with heavy resistance. It examines the historical dichotomy between state capacity and the prevalence of solidarity groups' opposition to central rule in four Afghan regimes: the monarchy of Amir Abdur Rahman, the communist regime of the People's Democratic Republic of Afghanistan and the Soviet occupation, the Taliban's Islamist theocracy, and President Hamid Karzai's democratic Islamic Republic. Charles Tilly's "four state activities" model is used to subjectively determine each regime's relative degree of state capacity in four areas: war-making, state-making, protection, and extraction. The basis and composition of major resistance groups during each regime are then analyzed. This thesis concludes with a comparative analysis of state capacity and resistance in each of the four regimes in order to draw implications for how the current government of Afghanistan can best expand its reach without creating further revolt and insurgency. These findings are not only important for the government of Afghanistan, but also hold serious implications for prosecution of the Taliban insurgency, as well as future international state-building and post-conflict reconstruction efforts.

KEYWORDS: Afghanistan, Monarchy, Abdur Rahman, Taliban, Islamist, Soviet, Communist, Hamid Karzai, Pashtun, Insurgency, Counterinsurgency, Capacity

TRANSFORMING COUNTERTERRORISM TRAINING IN THE FEDERAL BUREAU OF INVESTIGATION: PRESERVING INSTITUTIONAL MEMORY AND ENHANCING KNOWLEDGE MANAGEMENT

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The Federal Bureau of Investigation remains committed to working seamlessly with its international, federal, state, and local partners to counter terrorism, the number one priority of the FBI. In order to more effectively equip personnel to meet and counter the ever-evolving threat, it is critical that inefficient practices that cause counterterrorism practitioners to "recreate the wheel" be quickly transformed to promote the most efficient, counterterrorism knowledge management, knowledge transfer, and training practices available. Lessons learned through both formalized training and on-the-job experience must be quickly leveraged to aid broader sectors of the FBI and partner communities in order to promote streamlined operations in combating terrorism while countering inefficient knowledge management. This research identifies and analyzes the knowledge management deficit in counterterrorism training, while examining the core influences of organizational mindset and individual mindsets, the importance of trust, and the misnomer of "best practices" that must be acknowledged and overcome. Focused on the establishment of counterterrorism mobile-education teams to drive the enhanced infusion of tacit counterterrorism knowledge, this research culminates in the delineation of a multi-faceted strategy comprised of recommendations to target remaining counterterrorism training gaps, strengthen homeland-security collaboration, and combat terrorism.

KEYWORDS: Counterterrorism, Knowledge Management, Knowledge Transfer, Best Practices, Homeland Security, Training, Federal Bureau of Investigation, FBI, Expert Registry, Center for Lessons Learned, Skill Building, Storytelling, Organizational Change, Mobile Education Team, MET

THE CHAVEZ CHALLENGE: VENEZUELA, THE UNITED STATES, AND THE GEOPOLITICS OF POST–COLD WAR, INTERAMERICAN RELATIONS

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Hugo Chavez, who was elected to the presidency of Venezuela in 1999, has become exemplary of the wider phenomenon of post–Cold War populism (or neo-populism) in Latin America. He has successfully mobilized the poor in Venezuela and beyond, tapping into the resentment felt by the marginalized throughout the region after almost three decades of neoliberal economic reform. This thesis explores how successful he has been in promoting his brand of post–Cold War populism both regionally and internationally. There is an important connection between his populism and his foreign policy. This thesis argues that while Chavez has been successful at garnering the support of the poor, his ultimate goal has increasingly become a desire to consolidate his own power. In classic populist fashion, Chavez has drawn many Venezuelans into a hierarchical patronage machine, which is dependent on his continued occupation of the presidency and on the use of the country's oil wealth in order to survive. Furthermore, Chavez has taken significant steps to ally Venezuela with various rivals of the United States. However, despite his regionally- and internationally-oriented rhetoric about Bolivarian socialism and 21st century socialism, his efforts at building alliances to counterbalance United States hegemony are best understood by adopting a realist conception of Venezuelan foreign policy. His foreign policy can be viewed as being driven less by

ideology and more by a desire to strengthen Venezuela's position in the regional and international arena. This thesis also evaluates the ways in which the United States has dealt with the Chavez challenge and the effectiveness of the American approach. Ultimately, this thesis approaches Chavez as a symptom rather than a cause of broader political and socioeconomic forces at work. It takes the position that U.S. policymakers should be concerned about the Chavez challenge, but not alarmed. Although he may have initially been considered a serious threat to the American position in the region and beyond, his inability to create a robust coalition of nation states to counter U.S. hegemony is evidence that his influence, even in his own country, may have peaked.

KEYWORDS: Venezuela, United States, Latin America, Populism, President Hugo Chávez, Inequality, Foreign Policy, Ideology

A BURNING NEED TO KNOW: THE USE OF OPEN-SOURCE INTELLIGENCE IN THE FIRE SERVICE

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In the aftermath of September 11, 2001, the fire service found itself on the forefront of the war on terror. People within the fire service began to realize that they needed to share intelligence information with other government agencies in order to protect firefighters and their community. At the federal level, the national information-sharing strategy recognized that first responders are critical to the prevention of terrorism and that an effective flow of intelligence information must be established between federal, state, and local agencies.

However, the fire service has little experience in the field of intelligence and much of the intelligence available may not be specific or useful to the fire service. The local fire department is faced with the task of analyzing what a particular piece of information means to that department. Only the local department knows its procedures and locale well enough to accomplish this critical task.

This thesis seeks to assist local fire departments in building systems and training personnel to exploit open-source intelligence for their unique needs. Using information gleaned from interviews with experienced intelligence practitioners, the intelligence cycle is discussed in light of the needs of the fire service, including requirements, collection, analysis, and dissemination.

KEYWORDS: Fire, Intelligence, Firefighter Training, First Responders, Fire Service Intelligence, Open Source Intelligence, Fire Service

INCREASING INFORMATION SHARING AMONG INDEPENDENT POLICE DEPARTMENTS

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The events of September 11, 2001, clearly demonstrated the need for law-enforcement agencies at the local, state, and federal levels to increase their capacity to share information with one another. The 9/11 Commission asserted that the World Trade Center attacks occurred in part because law enforcement was unable to connect the dots, which may have provided the opportunity to disrupt the terrorists' mission. However, upon reflection and further investigation, it seems probable that prior to the attacks there simply was not enough information (dots) to raise concern or suspicion about that fateful day.

One can argue that the need for accurate information shared in a timely manner is the lifeblood of any agency responsible for defending the home front. This dynamic is further enhanced when municipal law enforcement agencies exist within a large urban area, such as Los Angeles County, California, which is a target-rich environment.

Using a quantitative analysis, this thesis examines information- and intelligence-sharing networks, data-collection methodologies, common technical platforms (voice and data), and financial considerations toward increasing information sharing among independent police departments. Methods to improve information-sharing capabilities are suggested.

KEYWORDS: Information And Intelligence Sharing, Intelligence Requirements, Intelligence Centers, Los Angeles Regional Intelligence Center, Joint Terrorist Task Force, Terrorists Early Warning Group, Fusion Centers, Intelligence Analysis, Common Technical Platforms, Interoperability, Data Banks, Data Collection, Financial Considerations, Disparate Systems, Emergency Communications, Independent Police Municipalities

TURKEY AND EUROPEAN SECURITY INSTITUTIONS

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Turkey's relationships with the West, particularly its relationship with Western security institutions, are today more important than ever. As the United States fights two wars in the region and attempts to rebuild its reputation in Europe and the Middle East, Turkey is once again central to America's plans. Yet, this crucial ally is little understood by U.S. policymakers. Turkey has a long relationship with Euro-Atlantic security institutions, specifically NATO and the various European institutions, culminating in today's European security and defense policy (ESDP).

This study poses several questions of relevance to those interested in theory and policy. Why do the government and people of Turkey participate in these institutions? What long-term policy objectives do policymakers in Turkey wish to advance through participation in these institutions? What are the different ways that Turkey leverages its participation to advance its goals? Specifically, how does Turkey use its participation in European security institutions to advance its positions on issues such as European Union membership, defense modernization, and its ongoing internal and external areas of conflict? How does Turkey's Ottoman legacy affect these relationships and how has this historical background shaped today's events?

This thesis seeks to answer whether Turkey is successful in its participation; in other words, does its participation allow Turkey to advance its goals better? How do current trends in Europe affect Turkey's participation in these institutions?

KEYWORDS: Turkey, NATO, ESDP, Partnership for Peace, European Integration, European Union

THE MINISTRY OF DEFENSE AND CIVIL–MILITARY RELATIONS IN MOLDOVA

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President Bush established the United States African Command (AFRICOM) in February 2007, and it was commissioned fully operational on 1 October 2008. AFRICOM was established to increase the Department of Defense's efficiency and effectiveness for African operations and exercises. It merged the responsibilities for the African continent into a single command in order to foresee and prevent crises in Africa that could threaten American strategic interests. This merger joined responsibilities previously

spread amongst the authorities of the United States European Command (EUCOM), the United States Central Command (CENTCOM), and the United States Pacific Command (PACOM). AFRICOM's location discussion has centered on access to the continent and minimized other important considerations, such as access to the USG and policy development, supporting infrastructure, and the stability of where it will operate. A location decision is a complex decision—one that has a long-term impact and, therefore, requires systematic analysis to make the process effective, efficient, and apolitical. This thesis follows several recent military efforts that utilize the business sector and associated applications to improve decision effectiveness and efficiency. Specifically, it applies the analytical hierarchy process (AHP) to the AFRICOM strategic-headquarters-location decision to provide a balanced, effective, and efficient review.

KEYWORDS: United States Africa Command, AFRICOM, Location Decision, Analytical Hierarchy Process, AHP, Strategic Decision Making

EXPLORING THE PLAUSIBILITY OF A NATIONAL MULTIAGENCY COMMUNICATIONS SYSTEM FOR THE HOMELAND-SECURITY COMMUNITY: A SOUTHEASTERN OHIO HALF-DUPLEX VOICE-OVER-IP CASE STUDY

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Since 9-11, it has become apparent that the homeland-security community is comprised of more than first responders; it is, in essence, a mega-community composed of government, business, and nonprofits. However, this has not translated into American communications strategies, which presently focus on radios for first responders in an emergency. Many reasons exist for not addressing this gap, including the myth that it is impossible or would be too expensive. Computer gamers, however, have been utilizing low-tech versions of half-duplex VoIP since the 1990s to connect millions worldwide. A southeastern Ohio VoIP system, consisting of health departments, hospitals, emergency-management agencies, and their partners, has been testing a similar system since 2003. This thesis offers a definition of the homeland-security community and provides criteria that are used to evaluate six communications systems for use as integrated national systems and to judge the plausibility of the Ohio system as a model. This thesis also proposes the concept of a "universal communicator" software system that would address the shortcomings of the Ohio system and provide an inexpensive solution that would ideally provide a national, homeland-security, real-time, voice-communications system.

KEYWORDS: Voice Over IP, VoIP, Interoperable, Communications, Megacommunity, Interagency, Multidiscipline

CRITICAL ACCOUNTABILITY: INTERDICTING AND DISRUPTING TERRORIST ACTIVITY IN THE U.S. BY EFFECTIVELY UTILIZING STATE AND LOCAL LAW ENFORCEMENT

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The events of 9-11 illustrated to U.S. government and law-enforcement agencies the critical need for definitive, cooperative, and accountable gathering and sharing of intelligence for terrorist interdiction/prevention. Despite billions spent annually for this endeavor, huge gaps in communication sharing and accountability remain. This thesis illustrates the realities of the current issues facing homeland security and proposes a conceptual model—homeland-security regional-cooperation areas (HSRCAs) –

based on proven, cooperative, drug-interdiction model programs that effectively utilize resources and training and establish interagency cooperation and accountability. Soft systems methodology is used to study current realities and generate solutions for human factors, which have previously created challenges in agency and program integration. The HSRCA model proposes specific performance-management processes, as well as governance by administrative members (responsible for daily state and local law-enforcement operations throughout the country). Such administrators placed in a collaborative environment are able to implement effective programs, while satisfying federal objectives within budget. HSRCAs will utilize state resources and existing fusion centers for shared regional communication, critical infrastructure protection, and widespread training. These activities—easily incorporated into daily activities of law-enforcement officers—empower them with the critical tools and information needed to interdict and defeat terrorist activities.

KEYWORDS: Homeland Security, State, Local, Law Enforcement, Information Sharing, Regional Collaboration

ANTI-RADICALIZATION EFFORTS WITHIN THE EUROPEAN UNION: SPAIN AND DENMARK

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Since 11 September 2001, the specter of Islamic terrorism has become an issue of increasing concern. The 11 March 2004 Madrid train bombings, the 7 July 2005 London subway bombings, and the 20 June 2007 Glasgow Airport attack brought home the threat of Islamic terrorism to the European Union (EU). To deal with this newly recognized threat, the European Union and its member states have used different approaches. Overall, the EU has turned away from traditional counterterrorism efforts, which tend to be reactive, toward the prevention of the radicalization that may lead to Islamic terrorism. But these anti-radicalization efforts are not coordinated, and the lack of a common anti-radicalization strategy may be hindering its efforts. This lack of coordination is best illustrated by the differing approaches taken by Spain and Denmark. Spain and Denmark's efforts represent two potential paths for the future of the EU. The EU can continue protecting existing national identities and multiculturalism or it can forge a common European identity.

KEYWORDS: Anti-Radicalization, Assimilation, Denmark, European Union, Integration, Islam, Multiculturalism, Muslims, Spain, Terrorism, Tolerance

FIVE YEARS OF CHINESE WORLD-TRADE-ORGANIZATION NEGOTIATIONS AND THE IMPACT ON DOMESTIC MARKET LIBERALIZATION

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China's markets liberalized as it forced its system to align with World Trade Organization (WTO) standards. A 2004 study examined China's agriculture markets to determine if China continued to liberalize after joining the WTO. The study found that China did liberalize and assessed that this would continue. Coincident with joining the WTO, China participated in the Doha agriculture negotiations. In 2003 and 2006, the negotiations collapsed; in 2008, China sided with India and talks collapsed again. Had China reverted to protectionism, moving from market liberalization? What did liberalization indicators and negotiation stances from 2003 to 2008 say about China's liberalization efforts?

Since 2003, China has met WTO obligations early and was not prepared to further lower market-access barriers. In negotiations, the sticking point was and continues to be developed members' large domestic supports, subsidies, and special benefits. Statements also point to an emerging alliance of developing nations that supports China and India. With this support, the G-20 will continue to act as the developing world's negotiator. The opportunity exists for these members to form a trade bloc to control developed member market distortions. This could adversely affect American farmers as they face higher tariffs and decreased market access abroad.

KEYWORDS: China, People's Republic of China, PRC, World Trade Organization, WTO, Agriculture, Negotiations, Doha, Doha Development Agenda, Trade, Market, G-20, G-33, Developing Countries, Market Liberalization, Market Access, Trade Agreements, Tariffs, TRQ, Safeguard Mechanisms, Alliance

THE NATO SPECIAL OPERATIONS FORCES TRANSFORMATION INITIATIVE: OPPORTUNITIES AND CHALLENGES

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Since the end of the Cold War in 1989–1991 NATO has engaged more extensively in expeditionary operations designed to establish and maintain stability in war-torn countries. From the Balkans to Afghanistan, NATO's special operations shortfall has been illuminated. At the Riga Summit in November 2006, NATO leaders decided to develop an allied special-operations capability. The NATO Special Operations Forces Transformation Initiative (NSTI) was agreed upon as the means by which the allies would improve such capabilities. This thesis investigates the extent to which NATO requires robust special-operations capabilities similar to American capabilities in order to respond to current and future threats. Because threats in the post–11 September 2001 environment are largely unconventional, NATO must develop a capability that can meet these threats in kind. The need to face and overcome unconventional adversaries is likely to increase as the scope of NATO's military operations extends to areas far from its traditional geopolitical space. This thesis concludes that the NSTI's objective—to enhance the special operations capabilities of the Allies—is well founded and should be properly funded and supported by appropriate command arrangements.

KEYWORDS: NATO, SOF, Special Operations, Asymmetric Threats, Unconventional Warfare, NSTI

ASSESSING THE POTENTIAL FOR INTERSTATE CONFLICT BETWEEN CHILE AND PERU: A POLITICAL–ECONOMIC APPROACH

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This thesis argues that the liberal theories of peace fail to explain the relationship that exists between Chile and Peru. Democratic and economic-integration theories posit that democratization and economic integration foster cooperation. Yet these do not accurately reflect current relations. It is posited that such an explanation must take into account the preferences of actors and their ability to act on those preferences. This research focuses on the executive, the military, and the legislature. This framework is applied to aspects of Chilean–Peruvian relations from 1968 to today. It is found that balance of power best defines the period 1968 to 1980. Yet competition is tempered by balance of identity and the nontraditional use of

confidence-building measures. The period 1980 to 2000 is characterized as an era of peaceful relations. Under various stages of democratization, executives are increasingly able to act on their preferences. Subordination of the military allows them freedom to pursue cooperative measures to help legitimize their administrations. Their ability to foster cooperation even reaches to nondemocratic neighbors. Since 2000, bilateral relations have deteriorated despite attempts by executives to strengthen cooperation. This is largely due to legislative constraints placed on Peruvian executives to increase domestic authority.

KEYWORDS: Chile, Peru, Interstate Relations

RUSSIAN-LANGUAGE PRESTIGE IN THE STATES OF THE FORMER SOVIET UNION

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The prestige of the Russian language has changed since the collapse of the Soviet Union. Nicholas Ostler, a linguist and language historian, categorized four reasons why an imperial language would remain after the colonizing power leaves. He applied this theory to Russian in the states of the former Soviet Union. He found that only Belarus maintains a significant enough number of Russian speakers to fall into one of his categories.

In this thesis research, it is found that the Russian language is prestigious in all fourteen former Soviet Union (FSU) states because of its use regionally as a lingua franca. The research begins with a review of language policy from tsarist times through today's Russia. This is followed by a demographic survey of the major languages in each of the fourteen FSU states, as well as a linguistic comparison of Russian with each republic's titular language. Next, using census data and language attitudes revealed through surveys and polls, it is shown that Russian is still prestigious in all FSU states, despite a decrease in the number of speakers, especially in younger generations. The research concludes with a review of Ostler's four categories and reasons why the author calls Russian a dying regional lingua franca.

KEYWORDS: Russian Language, Russification, Derussification, Language Politics, Language Policy, Language Prestige, Russian Federation, Russia, Former Soviet Union, FSU, Central Asia, Balkans, Estonia, Latvia, Lithuania, Ukraine, Belarus, Moldova, Azerbaijan, Armenia, Georgia, Turkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan, Kazakhstan, Estonian, Latvian, Lithuanian, Ukrainian, Belarusian, Moldovan, Azeri, Armenian, Georgian, Turkmen, Uzbek, Tajik, Kyrgyz, Kazakh

OPTIMIZING CITIZEN ENGAGEMENT DURING EMERGENCIES THROUGH THE USE OF WEB 2.0 TECHNOLOGIES

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Emergencies and disasters create hardships for citizens. To speed up recovery, local governments need to engage with citizens in an interactive, information-sharing system to convey data while an incident is still developing and to help mitigate and recover from damages. A lack of effective communication can decrease public trust and engender stress and anxiety among survivors. As service delivery becomes more complicated during an emergency, responders can also benefit from additional information from the public to increase situational awareness and better understand the challenges facing citizens.

This thesis examines emergency information needs, emerging information-sharing trends, and the potential homeland-security application of Web 2.0 technologies such as wikis, blogs, mashups, and text messaging. This thesis examines the use of Web 2.0 technologies during the Southern California wildfires

as a case study and interviews top emergency managers throughout the country, capturing their insights and opinions about the benefits and pitfalls of incorporating Web 2.0 technologies into existing emergency information-sharing systems. Local government agencies, the impacted community, and those outside the immediate area seeking opportunities to assist may be interested in the benefits of context-powered knowledge when collaboration from multiple sources converges to facilitate knowledge used for decision making.

KEYWORDS: Citizen Engagement, Web 2.0 Technologies, Social Networking, Twitter, Mashup, Wiki, Blogs, Emergency Management, Homeland Security, Communication, Text Messaging, Public Affairs, Public Relations, Southern California Wildfires, Psychological Coping Mechanism, Interactive, Information Sharing, Networks, Response, Recovery, Collaboration, Knowledge, Case Study, Crisis, Disaster, Citizen Reporters, Lessons Learned, Katrina, Fugate, Mega-community

SECURING THE PEACE AFTER CIVIL WAR

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This thesis focuses on the problem of recurring conflict in post–civil war states and seeks to understand the actions undertaken by the international community to alleviate this problem. Specifically, the thesis asks if the strategies of democratization, peacekeeping, and economic assistance have a positive impact on a post–civil war state's likelihood of sustaining peace. The thesis uses a multipronged approach to explore this question. First, the author conducts a survey of civil-war literature and identifies ethnicity, conflict intensity, and economic development as primary risk factors that lead to a recurrence of internal conflict. Next, the thesis examines the international community's democratization, peacekeeping, and economic-assistance strategies and what impact the risk factors have on the execution of these strategies. Finally, the author offers recommendations to the strategies that can help mitigate the influence of the dominant risk factors.

The thesis argues that risks associated with ethnicity, conflict intensity, and economic development directly influence the effectiveness of the strategies used by the international community. The likelihood that democratization, peacekeeping, and economic-assistance strategies will fail to sustain the peace can be assessed before the implementation of international action. Consequently, the ability to identify and assess these variables before the execution of policies allows the international community to identify high-risk environments and tailor their strategies to mitigate risk.

KEYWORDS: Civil War, Post-Conflict Stabilization, Democratization, Peacekeeping, Economic Development, Ethnic Conflict

VIOLENT CRIME: A COMPARATIVE STUDY OF HONDURAS AND NICARAGUA

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This thesis explains the variation between contemporary Honduras and Nicaragua in terms of their levels of violent crime. The thesis is driven by an empirical observation: Nicaragua, a country that shares a border with Honduras and where the U.S.-backed Contras waged a civil war against the Sandinista government during much of the 1980s, is considerably less violent than Honduras, which did not undergo civil war. This variation conflicts with expectations in studies of security in Central America that countries that have experienced civil war will, during the post-conflict period, experience higher rates of violent crime than countries that have not. In contrast, this thesis argues that, in Nicaragua, it was precisely the conclusion of

the civil war that drew attention from domestic and international actors who implemented changes that resulted in the demilitarization of internal security, the reduction of weapons in society, and the emergence of social movements that gave ex-combatants voice through nonviolent means. Honduras, which did not experience civil war and a subsequent peace process, has seen the circulation of large quantities of weaponry and ongoing military participation in internal security, which has meant human-rights abuses and low social capital.

KEYWORDS: Honduras, Nicaragua, Violence, Crime, Gangs, Security, Social Movements, Social Capital, Police, Weapons, Civil War, Post–Conflict, Peace Process

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